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Annual Refinery Number

The OIL AND GAS JOURNAL

MAR 29 1935

40

RODUCING

EFINING

ATURAL
ASOLINE

PELINE

ARKETING

STA-VOL-ENE

STABILITY VOLATILITY ENERGY

IT'S A "NATURAL"

SPEAKS FOR ITSELF!

The Courtship of Miles Standish

Nuf Sed!

A QUARTER OF A CENTURY
IN THE NATURAL GASOLINE INDUSTRY

Hanlon-Buchanan, Inc

PIONEER NATURAL GASOLINE MANUFACTURER

EXPORT TERMINALS:
Goodhope, La.
Houston, Tex.

TULSA, OKLAHOMA
NATIONAL BANK OF TULSA BUILDING
PHONE 4-1101 or L.D. 398 WIRE—OR WRITE P.O. BOX 1559
Cable Address . . . STAVOLENE, Tulsa, U. S. A.

FOREIGN REPRESENTATIVE:
Barks, Williams & Co., Ltd.
4 Lloyd's Ave.
London, England

TULSA, OKLAHOMA MARCH 28, 1935

IN MICHIGAN

they're giving the Big Bad Wolf the MITTEN

"right on the chin!"

Drilling for oil with UNION LINES is part of the program

6x19 Flexible Seale Rotary Drilling Line.

6x31 Tubing and Sucker Rod Line.

6x7 Sand and Bailing Line.

Michigan may be the "Wolverine State," but she's "putting the kibosh" on the Big Bad Wolf. For instance, the automobile business, which had a 38% increase in 1933, followed with a further *45% increase* in 1934, and is unquestionably the flag bearer among the industries in the march towards prosperity.

That isn't exactly bad news for oil men, and Michigan is doing things in oil, too. 441 wells completed in 1934, as compared with 296 in 1933. UNION Lines, built for oil field work, are favorites in Michigan and in on this picture.

Leonard Drilling Company, who have operated successfully in New York, Pennsylvania and Ohio, as well as Michigan, are 100% UNION Wire Rope users. This photo was taken in the old Isabella County field, in Michigan. The men are, front row, left to right: J. D. Leonard, General Manager; C. W. Clark, Vice President; R. M. Jones, Accountant; L. A. Dalton, Tool Dresser; F. W. Bannon, Jarecki Mfg. Co.; J. W. Leonard, Jr., Leonard Drilling Co.; J. E. Humphrey, Union Wire Rope Corp.; (Top Row) C. Chivington, Tank Builder; N. A. Corbin, Jarecki Mfg. Co.; E. V. Saylor, Driller; F. A. Donaldson, Union Wire Rope Corp.

UNION WIRE ROPE CORPORATION

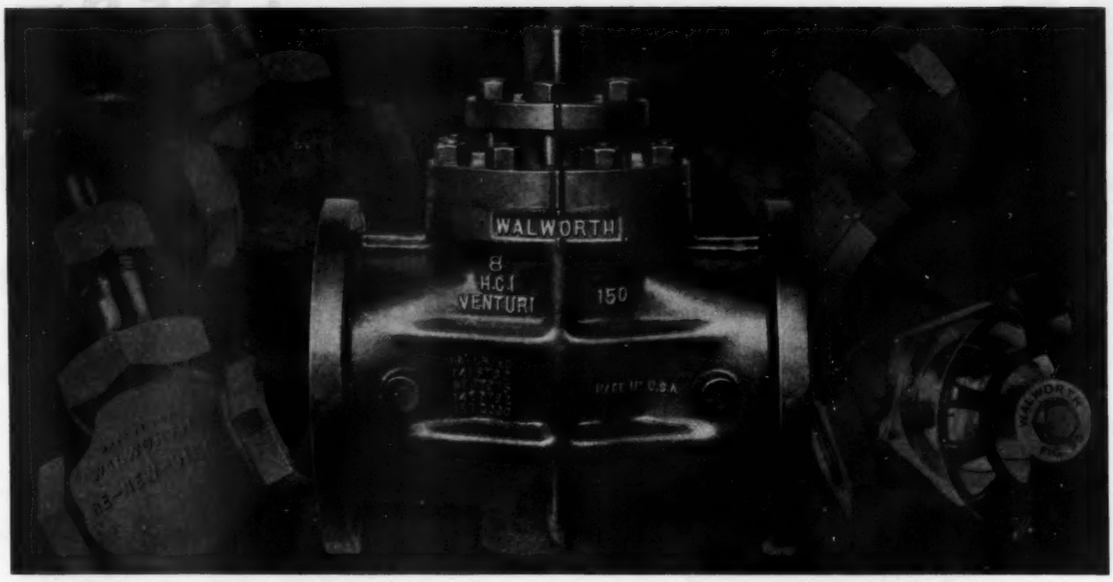
Executive and Sales Offices: 601 Beacon Life Bldg., Tulsa, Oklahoma

Branch Office and Warehouse: Portland, Ore. Warehouse: Monahans, Texas Factory and Accounting Dept.: 21st & Manchester, Kansas City, Mo.

JARECKI MFG. CO., Mid-Continent and Eastern Oil Fields Distributors
MARION MACHINE FOUNDRY & SUPPLY COMPANY, Rocky Mountain Fields
ENRIQUE O. CHAPA, Representative for the Republic of Mexico
Calle Damas Sur 13, Tampico Madero 2, Mexico D. F. Stocks at Tampico, Mexico
Export Agents: LUCEY EXPORT CORPORATION (Exclusive), 3503 Woolworth Bldg., New York, N. Y. Broad Street House, London E. C. 2, England

UNION WIRE LINES

The "ULTIMATE LOW COST WIRE ROPE"



CHOOSE Walworth Lubricated Plug Valves when needed . . . but . . .

Full direct flow port opening with one quarter turn — completely sealed, whether open or closed—positive tight shut off—freedom from attack by the fluids being handled — smooth turning — these advantages are yours with the Walworth Lubricated Plug Valves. They are available in all types for all pressure conditions.

But, they are not cure-alls. Economical valve performance demands a complete line, such as Walworth makes. If a Lubricated Plug Valve is the correct valve for a specific service, Walworth will recommend and supply the exact type. If one of the conventional types of gate or globe valves is suitable, Walworth makes and will recommend that specific valve.

Truly economical valve performance is assured by the Walworth Policy of the correct valve for the specific purpose — backed by a complete line of valves which makes impartial recommendations possible.

NRA

WALWORTH

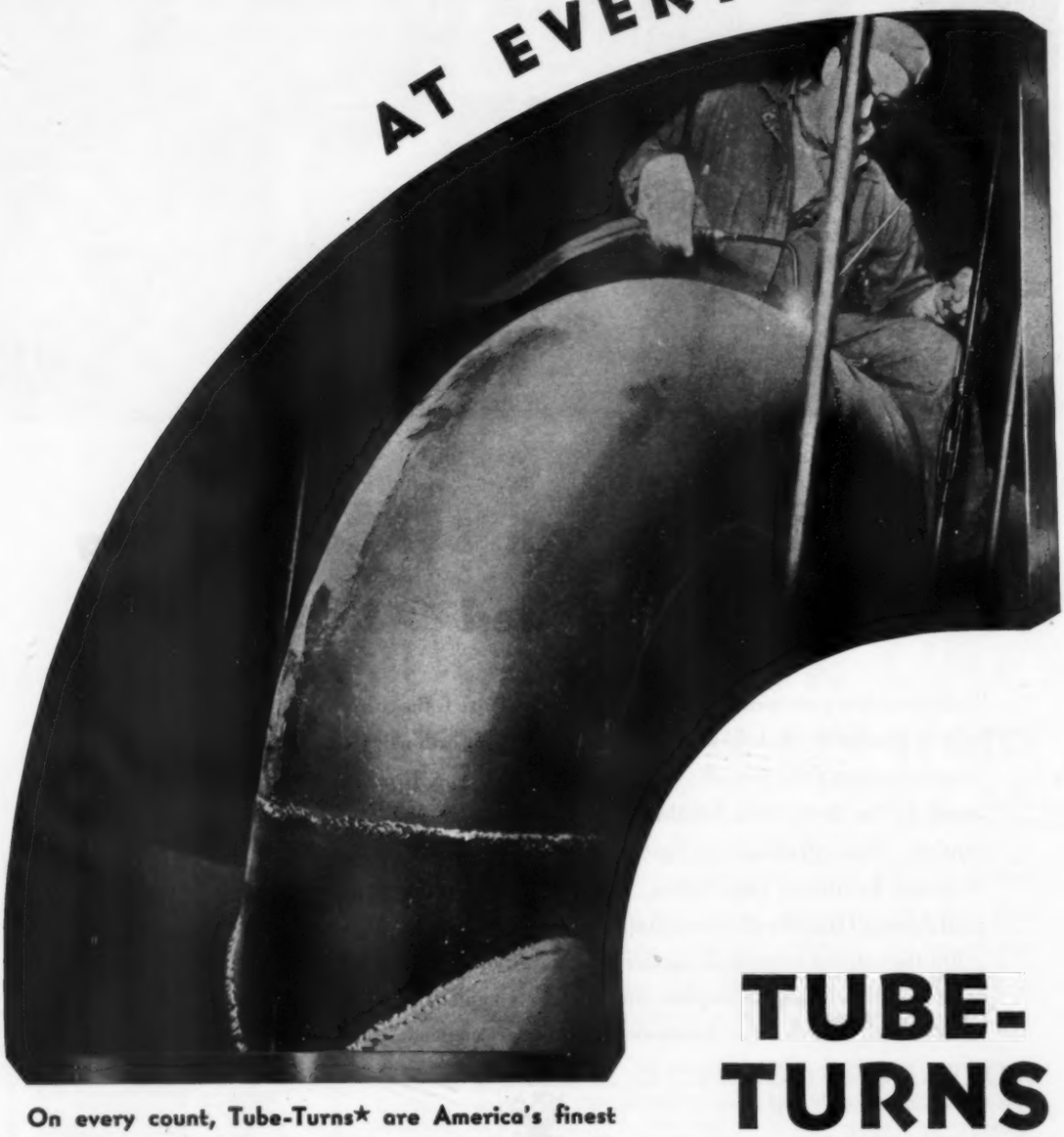
VALVES FITTINGS and TOOLS
Backed by 91 Years Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

The Oil and Gas Journal, issued weekly by The Petroleum Publishing Company, 114-116 West Second Street, Tulsa, Oklahoma. Subscription prices: Domestic, $6.00 a year; foreign, $7.00 a year. Current copies (except special numbers), 15 cents each. Entered as second-class mail matter December 15, 1911, at the post office at Tulsa, Okla., under the Act of March 3, 1879.

THE LEADER— AT EVERY TURN!



On every count, Tube-Turns★ are America's finest fittings for pipe welding—and have always been • • You can verify this fact in technical tests. But the proof is also found in one single truth: Tube-Turns are specified regularly by more engineers, more industrial buyers and more practical welders than any other fitting for pipe welding. Such a condition doesn't "just happen" • • Tube-Turns, Incorporated, 403 Herald-Post Bldg., Louisville, Ky.

TUBE-TURNS

★ The word "Tube-Turn" is NOT a general name for welding fittings. Tube-Turns are THE seamless fittings having uniform wall-thickness at all points, true circular cross-section, uniform radius of curvature and smooth inner walls. Made ONLY by Tube-Turns, Incorporated.

The Greeks had a use for it—but they didn't have . . . MONARCH WHYTE STRAND

'Going strong after 14 wells . . .

This report comes from a Texas driller using Monarch Whyte Strand: 'We used the line on 14 wells and it's still going strong. All future lines purchased by us will certainly be Monarch Whyte Strand.'

• • •

'It is remarkable the way this line has stood up.'

'Your rotary lines best since starting to run rotaries.'

MACWHYTE COMPANY
KENOSHA, WISCONSIN

MANUFACTURERS OF

a complete line of wire lines for oil fields—including Macwhyte Cable Tool Lines, Casing Lines, Sand Lines, Pumping Lines, Sucker Rod Lines and Coke Still Cracker Lines.

80 SO. 150-C

Get the facts about this Triple-Feature wire line for rotary drilling . . .

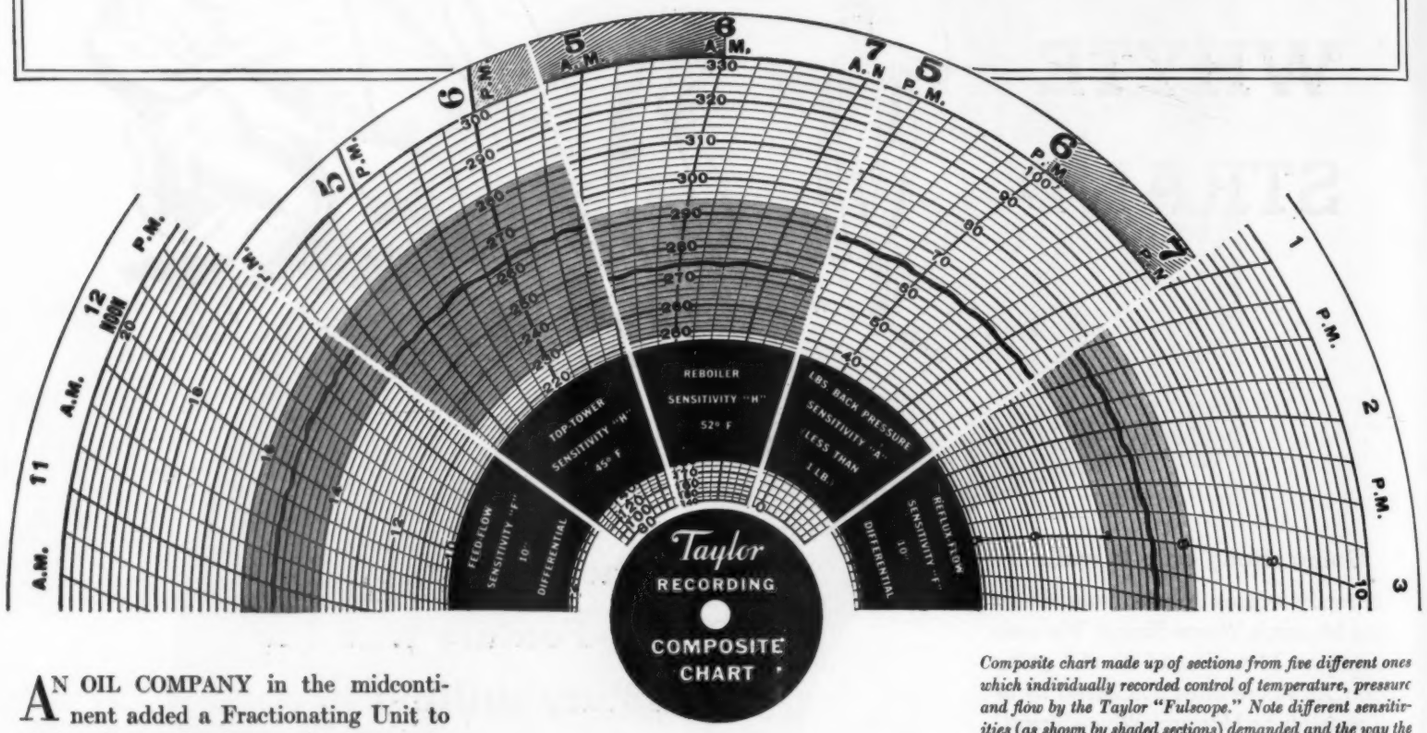
● Monarch Whyte Strand Rotary Lines are designed in accordance with A. P. I. specifications to withstand the extreme demands of rotary drilling. **1.** High strength is guaranteed by careful heat treating and drawing of each individual wire. **2.** A special kind of permanent internal lubrication protects each wire in the strand from internal corrosion and internal friction. **3.** Preformed construction withstands bending with minimum strain. • See Monarch Whyte Strand performance reports at left. And write for free sample, catalog and complete data.

MONARCH WHYTE STRAND—PREFORMED and Internally Lubricated Wire Lines

FRACTIONATING UNITS REQUIRE DIFFERENT CONTROLLER SENSITIVITIES

for temperature . . . pressure . . . and flow . . .

EASY TO GET THEM WITH A *Taylor* "FULSCOPE"


TOP-TOWER SENSITIVITY "H" 45° F
REBOILER SENSITIVITY "H" 52° F
LBS. BACK PRESSURE SENSITIVITY "A" (LESS THAN 1 LB.)
FEED-FLOW SENSITIVITY "F" 10" DIFFERENTIAL
REFLUX FLOW SENSITIVITY "F" 10" DIFFERENTIAL
Taylor RECORDING COMPOSITE CHART

Composite chart made up of sections from five different ones which individually recorded control of temperature, pressure and flow by the Taylor "Fulscope." Note different sensitivities (as shown by shaded sections) demanded and the way the "Fulscope" Controller maintained straight-line control in each situation.

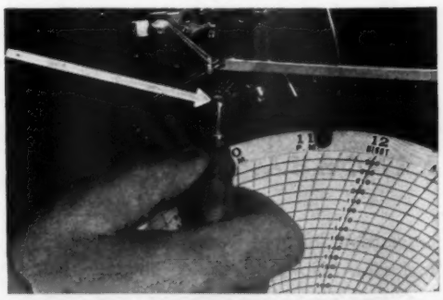
AN OIL COMPANY in the midcontinent added a Fractionating Unit to their refinery. Good control with steady throttling valve action was essential for flows, temperatures, and pressures . . . and there is *one best sensitivity* (or throttling range) for each application. The composite chart above shows what was required.

Flow control on the feed demanded Sensitivity F (10" water differential). Reflux Flow needed Sensitivity F (10" water differential). Reboiler Temperature control called for Sensitivity H (or 52° F.). Top Tower Temperature control demanded Sensitivity H (or 45° F.). Back pressure controls needed Sensitivity A (or less than one pound).

The different sensitivity (or throttling range) necessary for each operation was obtained by turning the "Universal Sensitivity Adjuster" of the Taylor "Fulscope" Controller to the proper point indicated on the dial by the letters. The operator used a screw-driver while the instrument was in action. No delays. No uncertainty. Instant adjustment. And straight line control that amazed the company's engineers. See the composite chart.

Here is just one example of the way the remarkable new Taylor "Fulscope" meets your needs. Previously, controllers did not have a low enough or high enough sensitivity. "Fulscope" has the wide range from high to low that you need for temperature, pressure or rate of flow control.

Let us show you how the Taylor "Fulscope" can be used to simplify and answer your control problems. For this help address Taylor Instrument Companies, Rochester, N. Y.; Tulsa, Okhahoma; Los Angeles, California; San Francisco, California; or Toronto, Canada.

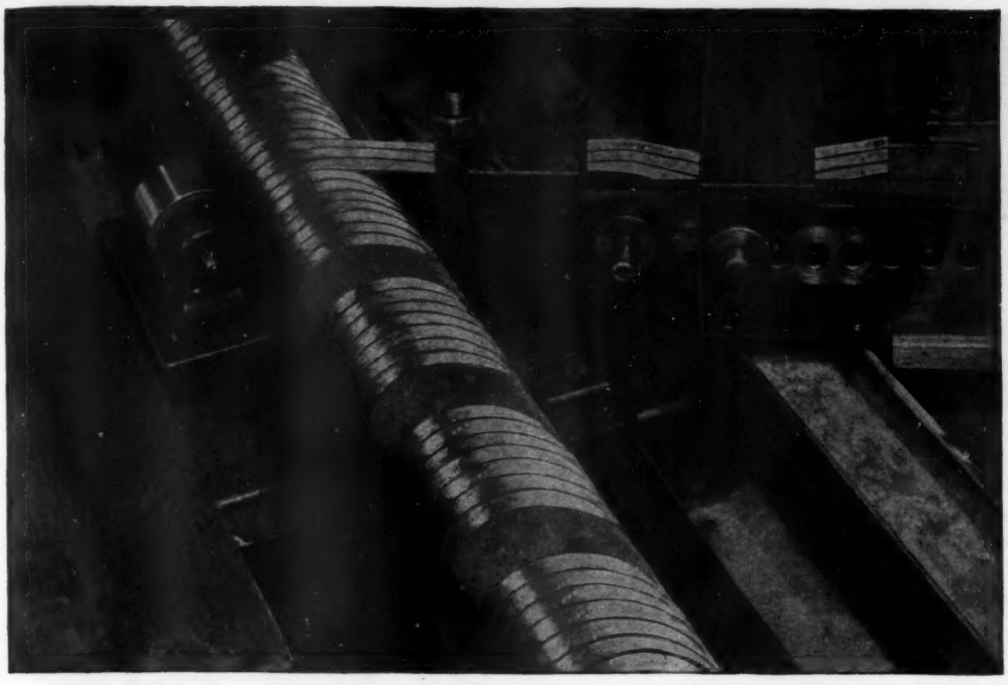


Taylor Fulscope Controller, with a close-up of the heart of the instrument, which is called the "Universal Sensitivity Adjuster." A screw-driver easily turns the adjuster to the correct sensitivity (lettered on the dial) for any control operation.

Taylor

Indicating • Recording • Controlling

TEMPERATURE, PRESSURE and FLOW INSTRUMENTS



A view of the Thermoid Rotary Hose Wire Winder. This machine applies wire with the precision of a thread-cutting lathe.

All Wound Up to Withstand 10,000 Lbs. of Pressure!

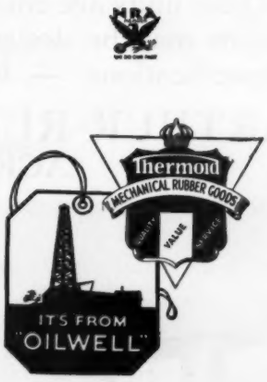
No matter how carefully the tube, duck, wire and cover are selected, nor how high the standards of workmanship, the strength of a Rotary Hose... and therefore its life . . . depends upon the precision application of the wire.

Only by absolute accuracy in winding the wire can elongation be properly controlled, or a hose be made free from axial twist and longitudinal deformations.

In Thermoid Rotary Hose the wire is machine wound. This insures uniform tension and uniform spacing throughout; also, that the wire is wound at the PRESCRIBED angle.

To do this job right, Thermoid engineers designed and built a machine that winds wire with the same accuracy that a lathe cuts a thread. Such precision is impossible with manual application.

All Thermoid Rotary Hose specifications are checked by the manufacture of samples which are tested to destruction under hydrostatic pressure before being released for production. They must withstand tests at least four times the pressures recommended for field service. Specify the hose that is *mechanically wound up* to withstand 10,000 lbs. of pressure to the square inch.



OIL WELL SUPPLY COMPANY

Branch Stores in all Oil Fields

DISTRIBUTORS OF

Thermoid

PRODUCTS FOR THE OIL INDUSTRY

Including Drilling and Pumping Transmission Belts — Rotary Hose — Air, Steam, Welding and Refinery Hose — Brake Lining and Packings.

THERMOID RUBBER COMPANY,
Trenton, N. J.

Gentlemen:

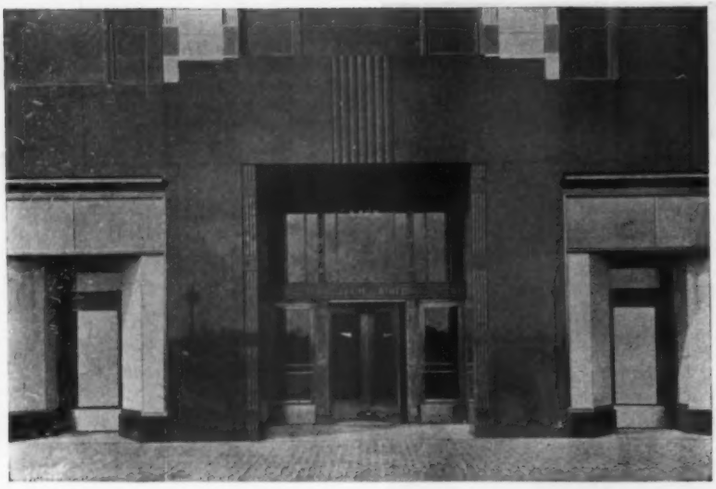
Please send me complete information on your Precision Wire Wound Rotary Hose.

Name_____

Company_____

Position_____

Address_____



The entrance to the Petroleum Building exemplifies its smartness and dignity.

THE PETROLEUM BUILDING

616 SOUTH MICHIGAN AVE. CHICAGO

"Home of the Chicago Oil Men's Club"

The accompanying views are good examples of what Chicago's New Oil Center has to offer in the way of unusually fine accommodations for oil companies having Chicago headquarters.

The impressive entrance, spacious modern lobbies and corridors all compose a fitting setting for the attractive office suites.

—o—

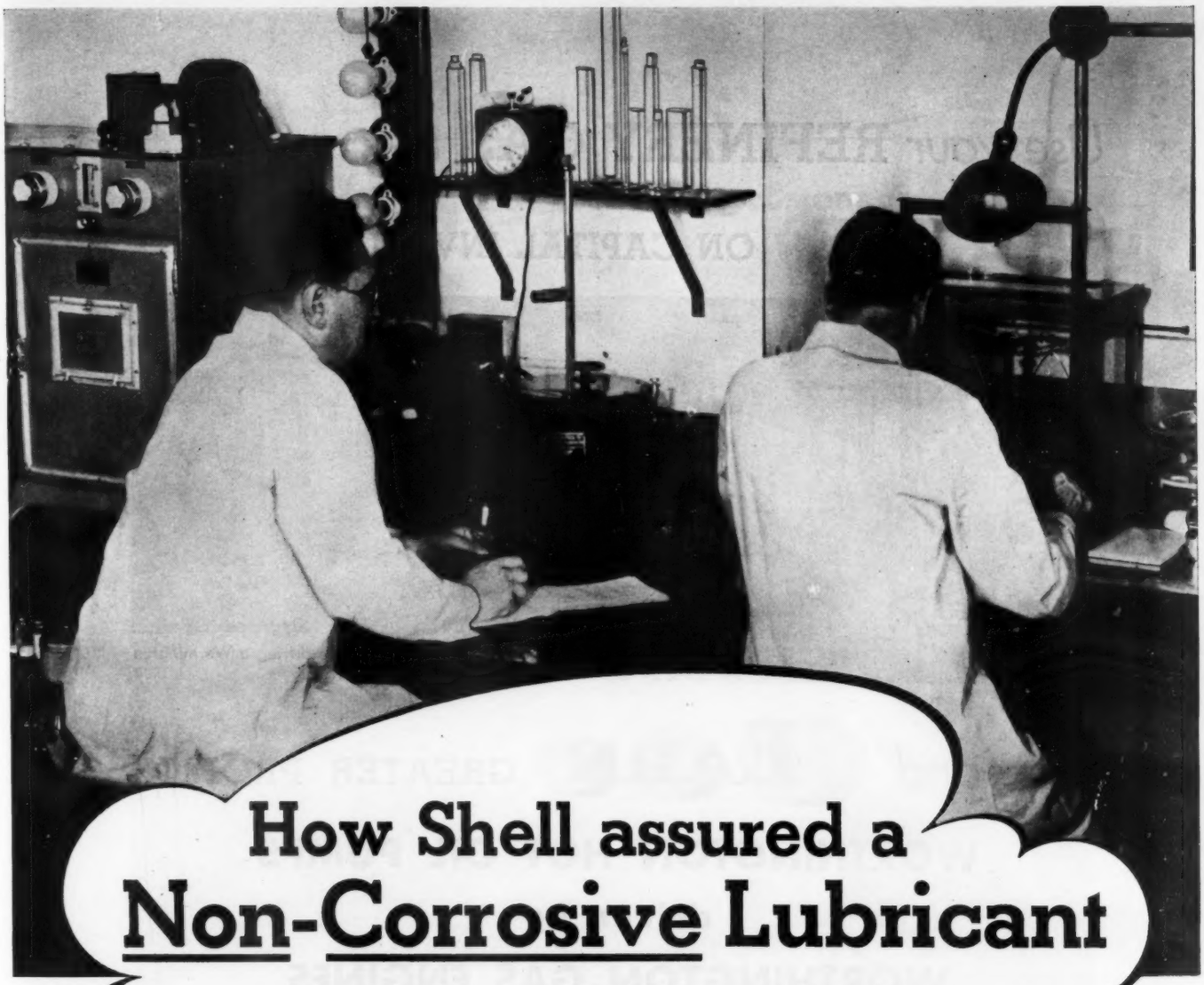
Several fine units are still available for Spring leasing. These units are entirely open so that new installations may be designed and built exactly to your specifications. For particulars apply

ARTHUR RUBLOFF & CO.
AGENTS

Upper floor corridor.

Typical office interior showing the even distribution of light from the new, specially designed Westinghouse fixtures.

Upper floor elevator lobby.



How Shell assured a Non-Corrosive Lubricant

—for today's new high-speed "Copper Lead" alloy bearings

WITH modern automobiles claiming speeds of 80. . . 90 . . . 100 miles per hour—

With higher compression motors and greatly increased horsepower . . . old-style metal bearings couldn't stand the gaff!

So new alloys of *"Copper Lead"* were developed by automobile manufacturers. Bearings capable of resisting tremendous strain.

But Shell engineers anticipated that these new "Copper Lead" alloy bearings would quickly corrode in contact with certain types of lubrication.

Exhaustive laboratory experiments were made. Shell Lubricating Oils were thoroughly tested—and accurately measured.

The results definitely proved beyond doubt that Shell lubricants were non-corrosive.

• • • •

These tests are typical of Shell's policy of manufacturing its products not only to meet existing specifications, but also to anticipate new and changing market requirements.

Nine strategically located Shell Refineries: Arkansas City, Kan.; Coalinga, Cal.; Dominguez, Cal.; East Chicago, Ind.; Houston, Texas; Martinez, Cal.; Norco, La.; Wilmington, Cal.; Wood River, Ill.

SHELL PETROLEUM PRODUCTS

Use your **REFINERY GAS** *to*

SAVE ON CAPITAL INVESTMENT

Worthington 240 hp. Vertical 4-cycle Gas Engine driving a Worthington 5⅛ x 24 Duplex Hot Oil Pump in a western refinery

and EARN GREATER PROFITS

WORTHINGTON HOT OIL PUMPS

driven by

WORTHINGTON GAS ENGINES

3310 b.hp. now operating in refineries throughout the United States . . . each unit earning additional profits for its owner . . . **by converting waste gas to useful power.**

Worthington offers undivided responsibility as builder of both the pump and the engine as a complete unit. Either vertical or horizontal 4-cycle engines available.

WORTHINGTON PUMP AND MACHINERY CORPORATION

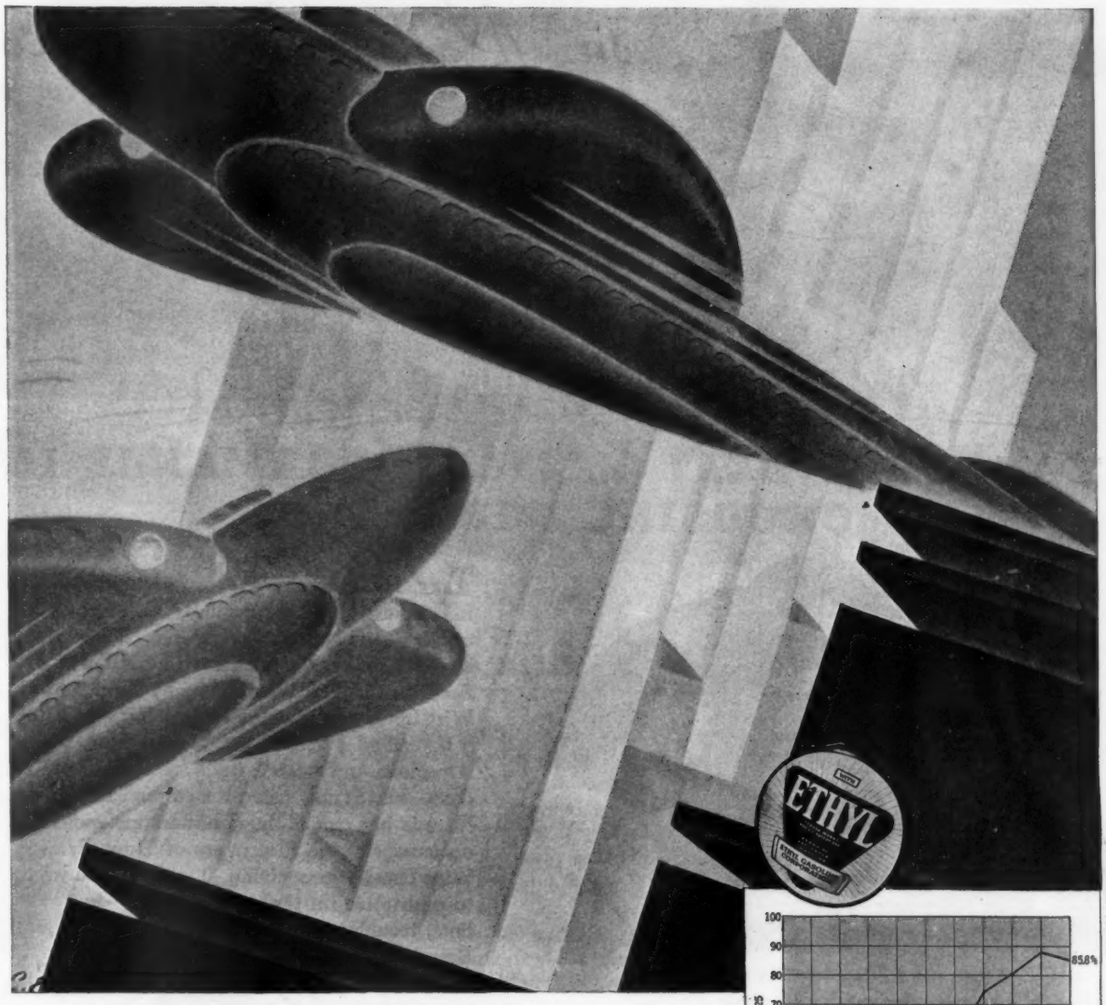
General Offices: **HARRISON, NEW JERSEY** - *Branch Offices or Representatives in Principal Cities throughout the World*

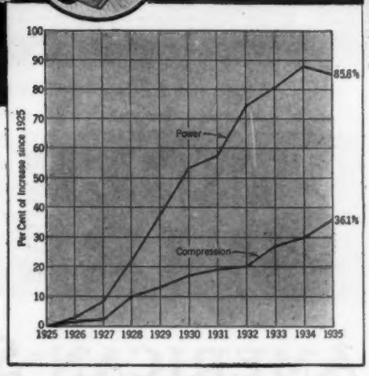
NRA CODE A-3825

WORTHINGTON

ATLANTA BOSTON BUFFALO CHICAGO CINCINNATI CLEVELAND DALLAS DENVER DETROIT EL PASO HOUSTON KANSAS CITY LOS ANGELES NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH ST. LOUIS ST. PAUL SAN FRANCISCO SEATTLE TULSA WASHINGTON

"... AND IN TODAY ALREADY WALKS TOMORROW"—*Coleridge*





This chart shows the influence Ethyl has had on motor car progress. The 36% increase in compression has been a primary reason for the 85.8% increase in power. It has avoided the uneconomical increases in engine size, cost and fuel consumption which would otherwise have been necessary. Approximately 95% of all premium gasoline sold in the United States and Canada now contains Ethyl fluid.

FAR-SIGHTED oil men see big Ethyl years ahead—base their opinions on the recent increased demands for Ethyl, further raising of compression ratios by car manufacturers, and better business conditions. Say these men, "The American public has always wanted the best, and wise merchants give it to them!" What are *you* doing about it? Remember, *now* is the time to build future Ethyl business; get the *new* cars rolling into your station. Ethyl Gasoline Corporation, New York City.

NEXT TIME — AND EVERY TIME — SELL ETHYL!

FREE! Ethyl Gasoline Corporation
Chrysler Building, N. Y. C.

Please send me the latest information on building service station sales.

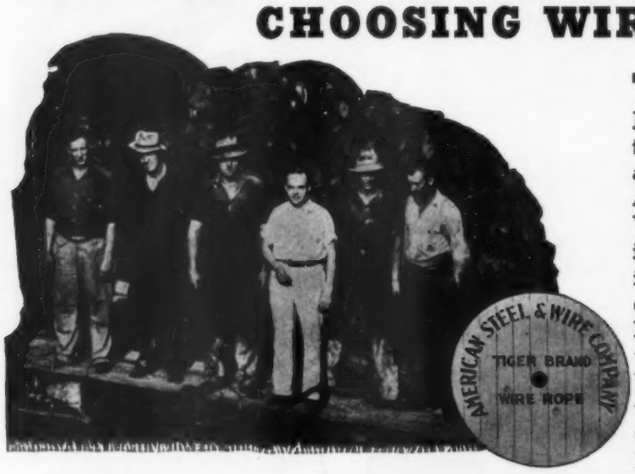
Name_____

Address_____

_____ 97-2

Horses ARE PICKED *on Past Performance*

YOU CAN'T BEAT PAST PERFORMANCE IN CHOOSING WIRE LINES

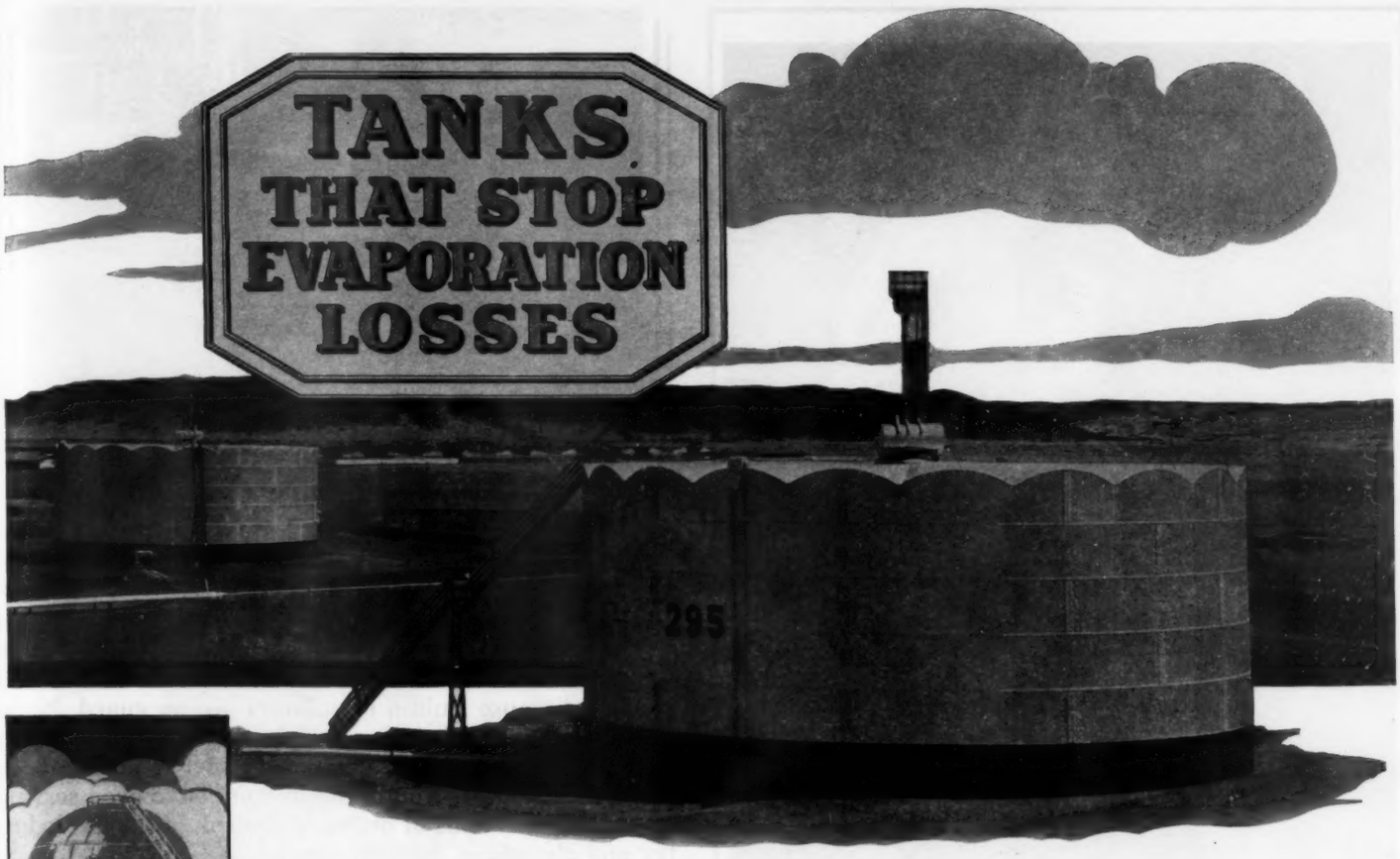


TAKE, for example, the experience of Mr. J. T. Akers, of Akers Brothers, Drilling Contractors at Owensboro, Kentucky. Some time ago Mr. Akers purchased 1600 feet of American Steel & Wire Company Tiger Brand Wire Lines—7/8" diameter 6 x 19 left lay. With it he drilled a total of 12,300 ft. of hole, used it to clean and swab 6 wells for a total of 180 days—and is now using it as a pumping line. Here is just one of the countless instances of unusual service that users of Tiger Brand Wire Lines are receiving. It will pay you well to capitalize on their experience—to save time, trouble and money by specifying Tiger Brand on your next order.

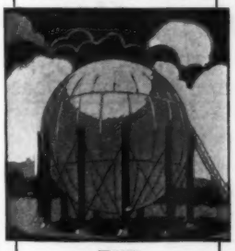
TIGER BRAND WIRE LINES
REG. U. S. PAT. OFF.

AMERICAN STEEL & WIRE COMPANY
208 SOUTH LA SALLE STREET • • CHICAGO
Offices in All Principal Cities

United States Steel Corporation Subsidiary



THE HORTONSPHEROID



THE HORTONSPHERE

THE WIGGINS BREATHER ROOF

THE WIGGINS PONTOON ROOF

Casinghead Gasoline protected against Evaporation in Radial Cone Tanks

The International Petroleum Company, Ltd. of Talara, Peru stores casinghead gasoline of 23 pounds Reid vapor pressure in two Radial Cone pressure tanks of 55,000 bbl. capacity. This gasoline is pumped from the plants in the field at a rate of 3,000 barrels per day, some of it used for blending and the balance shipped out by tanker.

The atmospheric temperature at Talara ranges from 65°F to a maximum of 96°F. At these temperatures the gauge pressures do not exceed 10 lbs., a condition which prompted the selection of Radial Cone Tanks for its storage.

It was found that the actual internal tank pressure varied between 5 and 6 lbs. in the cooler season and slightly higher during the summer but was never high enough to operate the relief valve set at 10 lbs., and cause evaporation loss.

When tankers are being loaded, the gasoline is pumped out at the rate of 4,000 barrels per hour and the internal tank pressure drops to a minimum of 1 pound.

The Radial Cone Tank is one of the three types of pressure tanks which we build for the elimination of evaporation loss. It is designed for internal pressures up to 10 pounds. The Hortonspheroid is designed for internal pressures up to 20 pounds and the Hortonsphere for higher pressures. With the Wiggins Pontoon Roof and the Wiggins Breather Roof, they provide a complete line of storage units that eliminate the tremendous losses by evaporation.

Consult our engineers on your evaporation problems. It is highly probable that such action on your part will be the first step toward a substantial reduction of evaporation loss and a very considerable financial saving. Such consultation is of course, entirely without obligation.

CHICAGO BRIDGE & IRON WORKS

Dallas—1241 Dallas Athletic Club Building	Chicago—2128 Old Colony Building	Philadelphia—1615-1700 Walnut St. Building
Houston—2919 Main Street	Detroit—1514 Lafayette Building	Boston—1517 Consolidated Gas Building
Tulsa—1606 Thompson Building	Cleveland—2204 Rockefeller Building	San Francisco—1054 Rialto Building
Birmingham—1536 North Fiftieth Street	New York—3147-165 Broadway Building	Los Angeles—1423 Wm. Fox Building

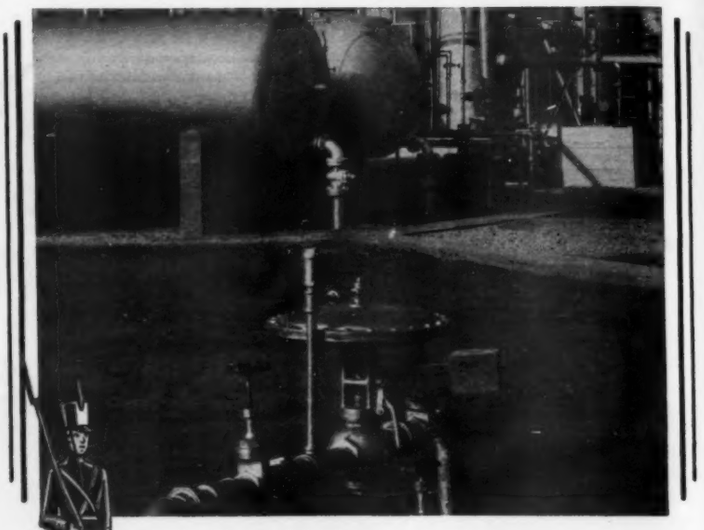
Fabricating plants in Birmingham, Chicago and Greenville, Pa.

FIRE! But the *tanks* are safe—*if* they are OCECO equipped.

No gas-tight tank equipped with OCECO Flame Arrestors has ever been lost by fire . . . . although 250 million barrels of tankage are thus protected!

Write today—tomorrow may be too late.

The Johnston & Jennings Co.
Oceco Division
877 Addison Road Cleveland, Ohio



On Guard!

A line carrying natural gas from the field to a large oil-company plant delivers the gas at an even pressure, in all weathers and at all seasons, because Fulton Regulators are on guard. Nothing unusual! Our illustration is like the picture of a sentry on guard, doing methodically what he has been trained to do well. Fulton Regulators have been serving all the requirements of pressure control, in the gas industry and elsewhere, for fifty years.

The Chaplin-Fulton Manufacturing Company
28-40 Penn Avenue Pittsburgh, Pa.

B-M-W PRODUCTS for pumping wells
The KEY to LOWER LIFTING COSTS
CORRECTLY DESIGNED . . ECONOMICALLY PRODUCED
REASONABLY PRICED

B-M-W NEILSON SAFETY SUCKER ROD HOOKS No. 25 & No. 40

POSITIVE LOCKING TYPE

Safe Working Load: No. 25—25,000 Lbs., No. 40—40,000 Lbs. Ball Bearing enclosed in Grease Packed Bail—permits of free swiveling. Simple but rugged latch arrangement assures safety—latch can be operated with thumb or finger. Molybdenum Alloy Steel construction gives this unit great strength. Write for data or inquire at your Supply Store.

BRADFORD MOTOR WORKS INC.
OIL WELL SUPPLIES
BRADFORD, PA. TULSA, OKLA.
EXPORT OFFICE—30 CHURCH ST.—NEW YORK CITY

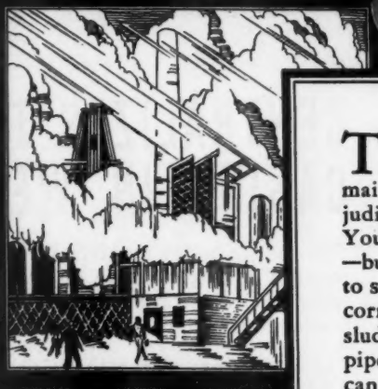
A Thought for ALERT REFINERY OPERATORS

FREE FROM SCALE

PERFECTLY ROUND

LONG LENGTHS

ELECTRIC RESISTANCE WELDED



THERE are any number of places around refineries where pipe maintenance costs can be cut by the judicious use of Toncan Iron Pipe. You don't need to use it everywhere—but where buried lines are subject to soil corrosion, where atmospheric corrosion takes its toll, or where acid sludge literally chews up ordinary pipe—that's where this better pipe can definitely do a job for you and save money.

Toncan Iron is an alloy of refined open hearth iron, copper and molybdenum with the highest rust-resistance of any ferrous metal in its price class. That's why it is economical. And that's why progressive refinery operators are using more and more of it all the time. You will always know Toncan Iron Pipe by its color—blue—and the RT stamped in the couplings.

Let us send you a copy of the book, "Pipe for Permanence." You'll be amply repaid for reading it.

UNIFORM WALL THICKNESS

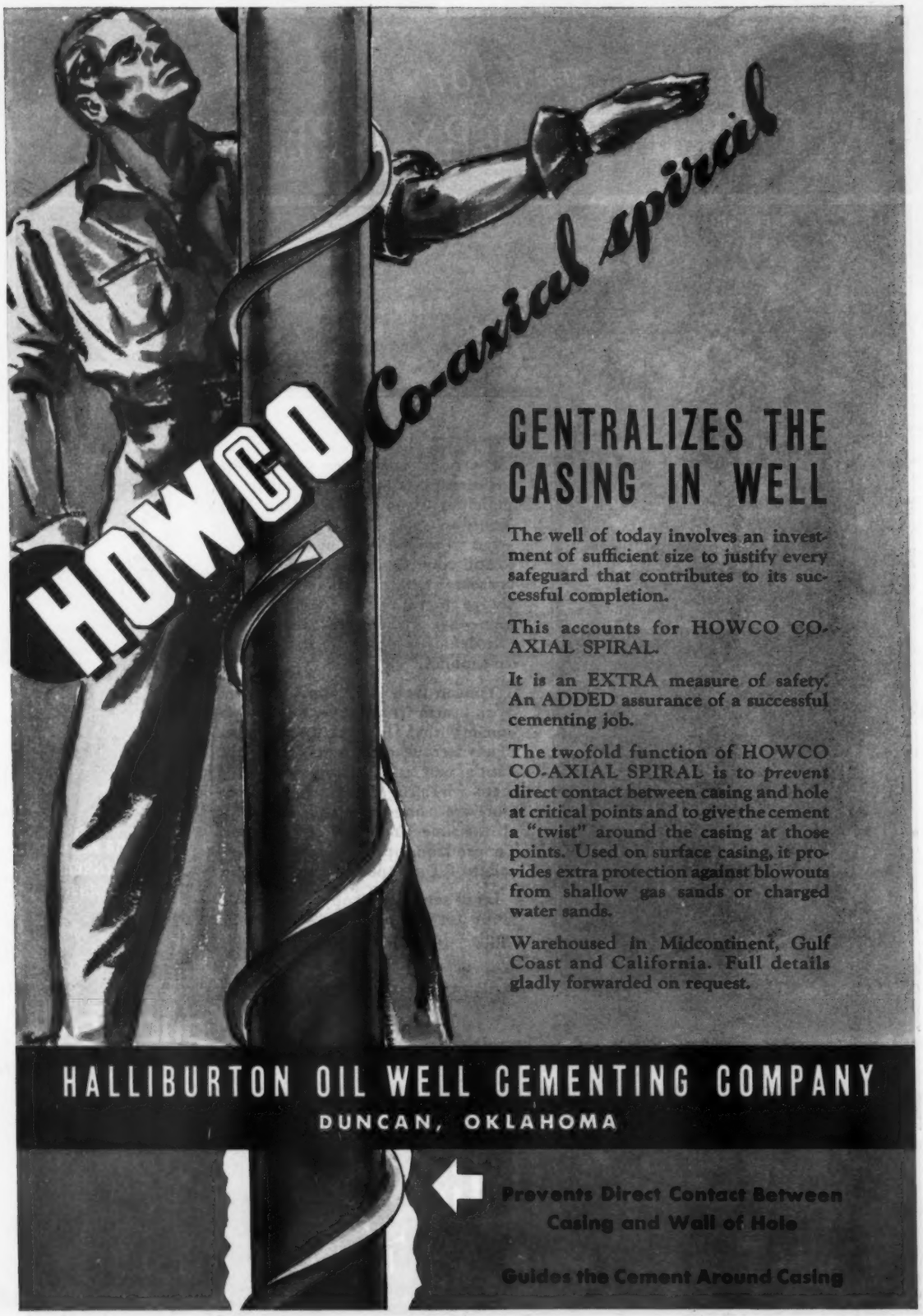
FOR WELDED OR THREADED JOINTS

REG. U.S. PAT. OFF. TONCAN COPPER MOLYBDENUM IRON PIPE

REPUBLIC STEEL

Republic Steel CORPORATION

GENERAL OFFICES · · YOUNGSTOWN, OHIO


HOWCO Co-axial spiral
CENTRALIZES THE CASING IN WELL
The well of today involves an investment of sufficient size to justify every safeguard that contributes to its successful completion.
This accounts for HOWCO CO-AXIAL SPIRAL.
It is an EXTRA measure of safety. An ADDED assurance of a successful cementing job.
The twofold function of HOWCO CO-AXIAL SPIRAL is to prevent direct contact between casing and hole at critical points and to give the cement a "twist" around the casing at those points. Used on surface casing, it provides extra protection against blowouts from shallow gas sands or charged water sands.
Warehoused in Midcontinent, Gulf Coast and California. Full details gladly forwarded on request.
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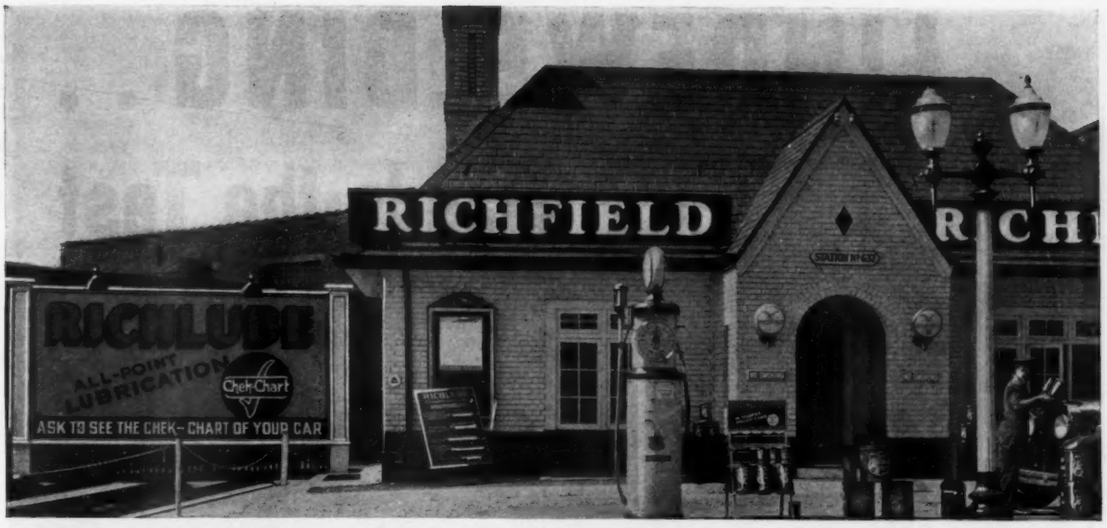
DUNCAN, OKLAHOMA
Prevents Direct Contact Between Casing and Wall of Hole
Guides the Cement Around Casing



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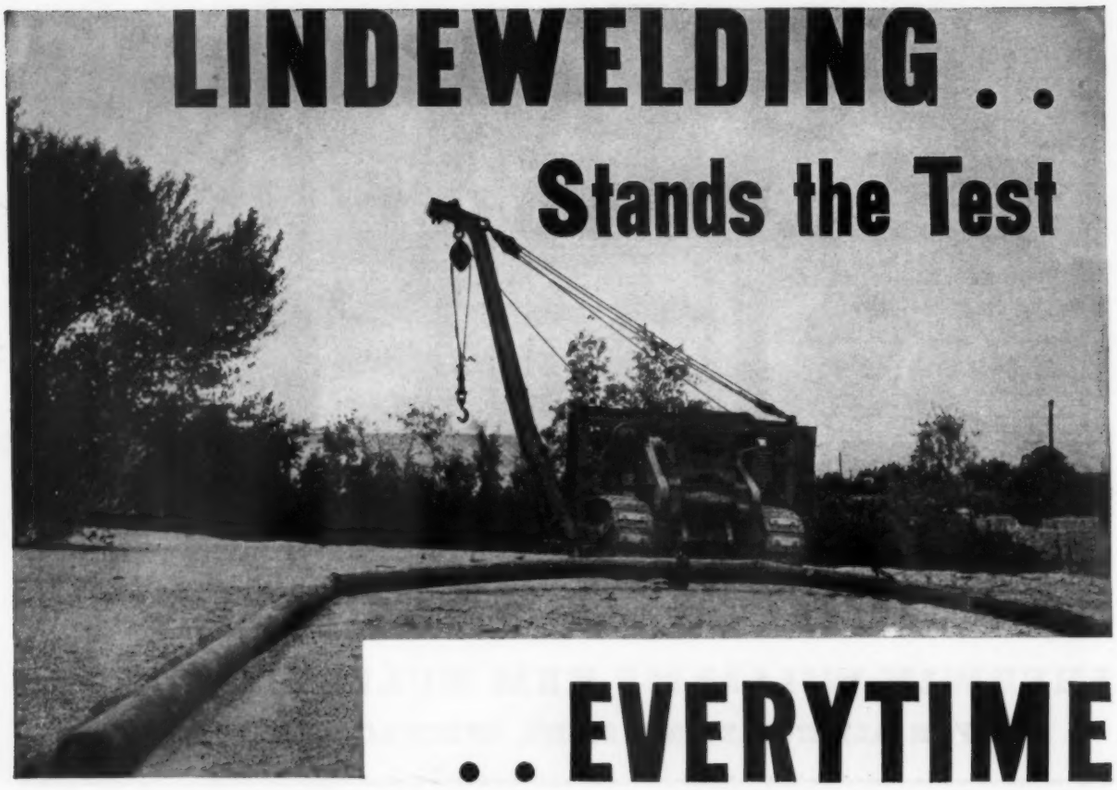

IT was an important gas-line river crossing. The company wanted the best job—strong, permanent, leakproof. For economy it was planned to use 1,400 feet of old 6-in. drill pipe. Would it be possible to realize all objectives? Linde Process Service was called upon for the answer.

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7 J

THE OIL AND GAS JOURNAL

Voulme 33
Number 45

March 28, 1935

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OIL MAN'S CALENDAR

March

29—Hutchinson, Kans., Kansas Chapter A.P.I.

April

2—Los Angeles, Calif., Pacific Coast district, A.P.I. Division of Production.

4—Los Angeles, Calif., California Natural Gasoline Association.

4-5—Excelsior Springs, Mo., Western Petroleum Refiners Association, annual meeting.

8-13 — Houston, Tex., Oil Equipment and Engineering Exposition.

10-11 — Amarillo, Tex., American Petroleum Institute Mid-Continent Production Division, spring meeting, Herring Hotel.

10-11—Indianapolis, Ind., Indiana Independent Petroleum Association, spring convention, Hotel Severin.

11-13—Dallas, Tex., Petroleum Industry Electrical Association, Baker Hotel.

18-19 — Cleveland, Ohio, National Petroleum Association, semiannual meeting, Hotel Cleveland.

25-26 — San Antonio, Tex., American Petroleum Institute Southwestern Production Division, Plaza Hotel, spring meeting.

May

1-3—Tulsa, Natural Gasoline Association of America, Hotel Tulsa.

6-9—Memphis, Tenn., Natural Gas Department, A.G.A., Peabody Hotel.

8-11—Tulsa, Oil and Gas Power Division of A.S.M.E., Mayo Hotel.

14-16—Tulsa, American Petroleum Institute, fifth mid-year meeting, Mayo Hotel.

June

20-21 — State College, Pa., Pennsylvania Grade Crude Oil Association, annual meeting.

September

25-27 — Atlantic City, N. J., National Petroleum Association, annual meeting, Hotel Traymore.

November

4-5 — Dallas, Tex., I.P.A.A., annual convention.

11-14 — Los Angeles, Calif., American Petroleum Institute, sixteenth annual meeting, Biltmore Hotel.

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Kansas Continues in Limelight as Operations in Other Areas Show Generally Small Output

By ANDREW M. ROWLEY

KANSAS continues as an especially active center of oil field development in the United States, despite the dust storms which have hampered operations. During the past week the state not only established another new high record for all time production but recorded the completion of 22 wells of which 17 were productive, and the starting of 41 new operations. A new pool was opened in Rice County when a test of the Gypsy Oil Company started making 100 barrels a day, with a larger output expected later. This completion marks the opening of the fifteenth oil pool in that county.

While drilling operations in other areas continue to increase no outstanding results have been obtained so far. Large producers are being completed in the Fitts Pool in Oklahoma and exploration work is steadily gaining headway in the southern part of that state. Producers in Oklahoma will have to pay an additional tax of 2 per cent on crude oil output starting April 1 when the new law, providing for a 5 per cent tax on gross production, will become effective with the signature by Governor Marland.

In the Texas Gulf Coast area, the Humble's well in the Anahuac section of Chambers County, after coring deeper, is flowing 30 barrels an hour. The Texas Company completed the first commercial oil producer in the Miocene Sand in the southeastern part of the Manvel Field, Brazoria County, when its test began making 14 barrels an hour.

Four dry holes in northern Louisiana and two oil wells and one gasser in Arkansas were the results of the week's operations in those areas. California is still involved in the seamen's strike which is handicapping operations of oil tankers and little progress seems to be made in settling the difficulties, the seamen's union not being willing to arbitrate differences until a closed shop is adopted although votes of employes showed a majority against the seamen's union, according to reports.

Activity in New Mexico has been stimulated by good results obtained in operations in the Monument and Cooper areas and operators in Michigan were watching closely two wildcats in the central part of the state which gave promise of finding production, one in Montcalm County and the other in Midland County.

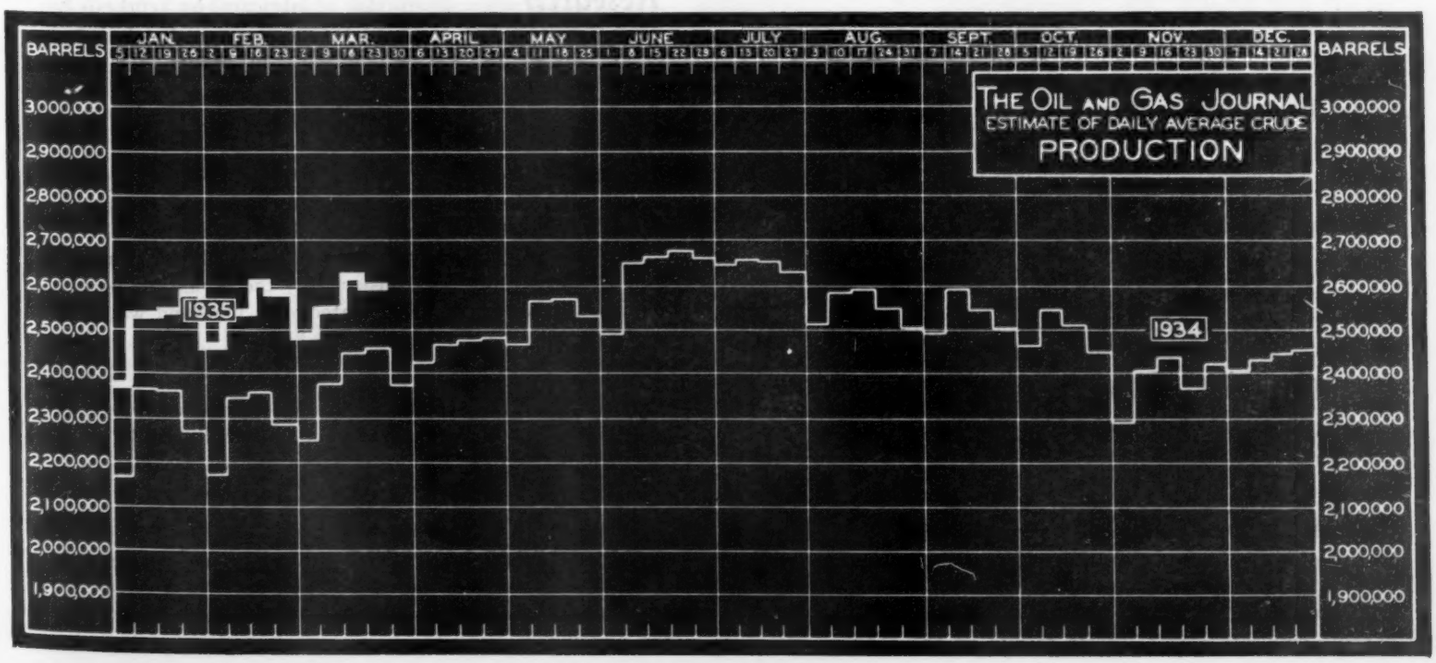
The refined oil market is improving with gasoline prices firm and stronger in the Oklahoma territory and a more optimistic attitude evident along the Atlantic Seaboard. Checking of "hot" oil production in East Texas and the buying movement on the part of larger companies, which has been absorbing distress gasoline, are contributing factors in the better conditions.

Crude Oil Production in the United States

Estimated daily average production for the week ending March 23, a comparison with previous week and the Federal allowables follow:

		Federal allowable	
	March 23	March	March 16
Oklahoma—			
Oklahoma City	162,975	.....	162,900
Seminole-St. Louis	100,775	.....	99,825
Remainder of State	250,795	.....	248,084
Total Oklahoma	514,545	491,000	510,809
East Texas—			
Lathrop	160,310	.....	160,302
Kilgore	150,270	.....	151,718
Joiner	145,219	.....	146,624
Total East Texas	455,799	.....	458,644
West Texas	145,975	.....	145,898
North Central Texas	90,260	.....	90,257
Texas Panhandle	65,055	.....	60,562
East Central Texas	52,427	.....	52,387
Gulf Coast—Texas	181,890	.....	179,169
Southwest Texas	60,264	.....	59,730
Total State of Texas	1,051,670	1,020,100	1,046,647
Kansas	153,050	139,700	149,741
North Louisiana	23,060	.....	23,175
Gulf Coast—Louisiana	95,243	.....	97,180
Total Louisiana	118,303	110,500	120,355
Arkansas	30,815	31,900	30,795
Eastern Fields (except Michigan)	105,250	105,500	104,750
Michigan	36,912	31,600	36,867
Rocky Mountain area	95,320	97,400	94,320
California—			
Santa Fe Springs	39,100	.....	39,750
Long Beach	65,250	.....	69,750
Mountain View	12,000	.....	14,100
Elwood	10,500	.....	9,500
Kettleman Hills	65,250	.....	61,100
Remainder of State	309,900	.....	336,300
Total California	502,000	492,600	530,500
Total United States	2,607,865	2,520,300	2,624,784

Decrease 16,919 Bbls. Daily.



The Bulletin Board

Operating Refineries in the United States were increased in capacity 125,000 barrels daily during the past year and more refineries are operating now than at any previous time in the history of the industry. There are 687 refineries in the United States with a capacity of 4,281,694 barrels daily of which 496 plants are operating with a capacity of 3,815,470 barrels daily.

•

Panhandle Natural Gas would be transported to St. Louis and Detroit in pipe lines financed by the Federal government and also utilized as fuel in plants which would provide electricity for the entire area surrounding the field in a combination plan proposed by Congressman Marvin Jones of Amarillo, Texas for the utilization of the vast quantity of natural gas now being wasted in the field.

•

John E. Shatford has been named by the Planning and Coordination Committee as National Coordinator to succeed the late Howard Bennette, subject to the approval of President Roosevelt.

•

Geologists to the number of 1,150, attending the twentieth annual convention of the American Association of Petroleum Geologists at Wichita, Kansas, were told one of their obligations is to prepare reliable estimates of crude oil reserves because of the growing importance of such figures due to the increasing difficulty in finding new oil fields.

•

Asphalt Seeps play an important part in the location of commercial oil fields through indication of nearby oil bearing formations. Such seeps are found in all parts of the world but predominate in the area surrounding the Gulf of Mexico.

•

The Bureau of Mines at Bartlesville, Okla., has developed a laboratory vacuum distillation apparatus that operates at an absolute pressure of 1 mm within the vapor zone and by using the test apparatus and procedure the refiner is better able to judge the lubricating oil content of the crude.

•

Petroleum Coke is an ideal household fuel if its properties are understood and certain precautions taken in burning it. Its high heating value, cleanliness and relatively low cost permit its general acceptance in areas where coal is used generally.

•

A New Apparatus has been developed by the Sinclair Refining Company that permits study of motor oils under conditions of service that closely approximate those in the automobile and the results derived from the new apparatus duplicate actual service results on the road.

Petroleum Code Survey Committee, named by Oil Administrator Ickes, recommends that appropriate legislation be enacted by Congress forcing integrated companies to split into separate corporations for each branch of the industry. Numerous other recommendations are made in the exhaustive report of the committee.

•

Trends in Petroleum Refining point to an enlarged use of chemicals for the stabilization of motor fuels and lubricants, lower viscosity motor oils, the adoption of gas cracking as a means of building octane values and the broader use of selective solvents for refining and dewaxing lubricating oils.

•

One Million Barrels of gasoline have been processed through the 100-ton clay vapor phase treating unit at the Pan-American Refining Company's new plant at Texas City, Texas.

•

The Interstate Compact was ratified by the House of the Texas legislature. Congress will be asked to enact consent legislation when the Texas senate ratifies the measure and it is signed by Gov. Allred.

•

Solvent Plant Capacity was increased during 1934 to an extent where the addition can care for one-third of the lubricating oil needs of the United States, according to a world survey.

•

Research in the production of lubricants by synthesis has been encouraged by the need for lubricating oils which have special properties to withstand unusually high temperatures and pressures.

•

Pressure Drill Completion of a new well in the Fitts Pool permitted a constant check of formations as penetrated and the testing of producing strata as encountered. Under this system no mud fluid is in circulation while the hole is being completed, consequently the permeable portions of formations are not impregnated with mud and water.

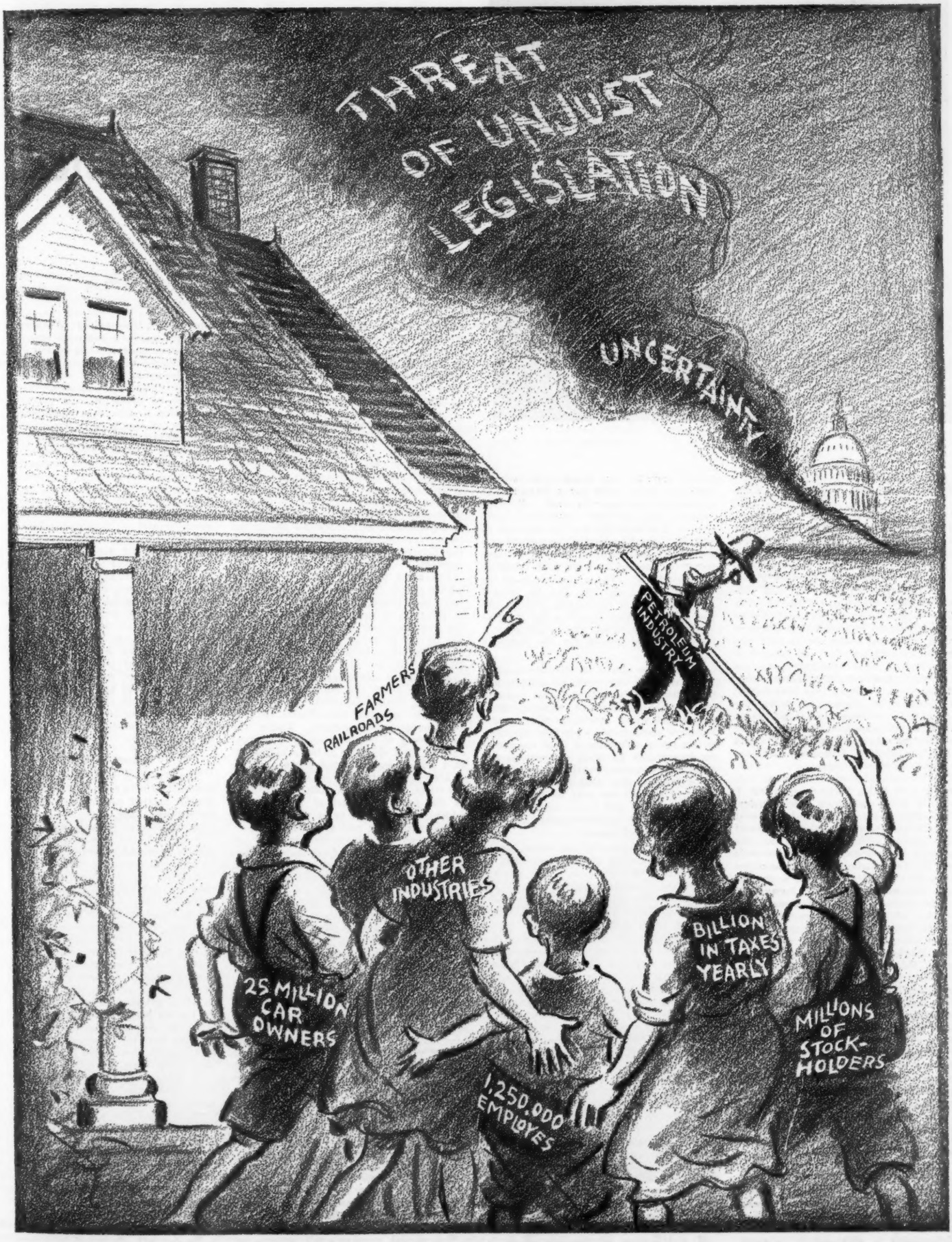
•

North Louisiana is divided into two geological provinces, dissimilar in all respects and wholly unlike in the formations from the surface down to the basement rocks.

•

The Market Demand feature of oil conservation laws of Texas was extended for two years by action of the House of the Texas legislature. The senate has not acted on the measure.

Worse Than Dust



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—Photo by John C. Day.

Committee on Survey of Code Recommends Segregating Branches

By HUGH D. MALLON
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Mar. 28.—The Petroleum Code Survey Committee named by Administrator Ickes has submitted its report. The committee was composed of Paul Blazer, Ashland Refining Co.; Mason Houghland, Spur Distributing Co., Nashville, Tenn.; R. E. Allen, California Oil and Gas Committee; H. B. Fell, Independent Petroleum Association of America, and Sidney Swensrud, Standard Oil Co. of Ohio.

The report recommends that appropriate legislation be enacted by Congress forcing integrated companies to split into separate corporations for each branch of the industry. The committee does not recommend, however, that management and operation of the various branches of the industry be changed, it being the opinion that the separated corporations, without interference with the control and co-ordination of over-all operations, would assure "arms-length" transaction between the different corporations.

This recommendation is submitted, it is said, because Rules 4 and 6 of Article V have not been obeyed by the industry. These rules relate to selling below cost and to the use by integrated companies of profits from their operations in one branch of the industry to subsidize their losses in other branches. The committee asserts that small enterprise in the industry has suffered severely because of the wide-spread violation of these rules.

Neither of these rules has ever been tested in the courts, only one case having reached the initial stages of court procedure, but being withdrawn by the Government before any action was taken on it. Both rules are claimed to be absolutely illegal in their present form, and serious doubts have been raised as to the possibility of making them valid in the eyes of the law.

The committee believes separation such as recommended, together with the requirement that reports be filed at stated intervals concerning the financial results of operations of companies having joint management, would exert financial and publicity pressure toward "abandonment, or reform of the notoriously uneconomical and unprofitable marketing operations of many integrated companies."

Separate Reports

As an immediate step toward determining costs for the purposes of ascertaining when sales are being made below cost in violation of Rule 4, and to assist in determining to what extent, in violation of Rule 6, operations in one branch of the industry are being subsidized by revenues from some other branch, the committee recommends that all integrated, and partially integrated companies of substantial size, be required to submit to the oil administrator profit and loss statements covering their operations, separated into each of the four branches of the industry. The committee is of the opinion that such data can be secured under Section 6 of Article VII of the code. This section provides for the collection of statistical and other reports which may be needed for the purposes of the code.

Inability to attain an effective and assured control over crude oil supply has been the most important factor contributing to the weakness of refined product prices and which endangers the maintenance of present code oil prices, the committee states. Further, it is of the greatest importance to small enterprises, not only in production, but in other branches of the industry, that such control be achieved as will not only be effective in fact, but which will insure confidence by leaving the least possible doubts as to its continuing effectiveness.

For these reasons the committee favors such legislation as may be necessary to accomplish this purpose. No specific legislative recommendations were included, but the committe probably would favor legislation similar to the Thomas bill now pending in the Senate.

To alleviate the position in which the nonintegrated refiners are at present due to the low price of refined products and the posted price of crude oil the committee offers two remedies: First, by increasing the prices of refined products to a parity with posted crude oil prices, or second, by a reduction in the crude oil prices to a parity with refined product prices, the committee preferring the first alternative.

Commenting on the present situation in refined prices the committe says that a program for the relief of refiners is being considered, the purpose of which is to stabilize both tank car and retail gasoline prices at levels which will place them in proper relation with prevailing crude oil prices. This program, the committee states, includes a concerted informal buying of tank car gasoline from small refiners by the larger companies. It is recommended that the oil administrator give this program his support.

If stabilization of gasoline prices is not quickly accomplished, the committee states, "we recommend that crude oil prices then be reduced sufficiently to correspond with refined products prices." A drop of about 20 cents a barrel would be necessary to make crude oil and gasoline prices conform with the ratio of 18.5 to 1 as set forth in the code.

Gasoline Production

Compacts between refiners, subject to the approval of the administrator, for the purpose of voluntarily restricting gasoline production below the allocations given them under Sections 3 and 4 of Article IV of the code, and to transfer to smaller companies all or any part of that portion of their allowable production thus curtailed, are also recommended in the interests of stabilizing the refinery markets.

Returning to Rules 4 and 6 the committee states that these rules appear to have constituted the principal attempts in the code to safeguard the position of the nonintegrated units engaged in only one or two branches of the industry and to protect them from subsidized, destructive competition.

Most of the complaints received by the committee allege the use of profits from low cost flush production or pipe line profits to subsidize unprofitable refining and marketing operations. Under the code theory of conservation it is pointed out the chief objective is the achievement of a high enough average crude oil price to keep in operation the majority of stripper wells. This creates additional revenue in the production end of the industry which some claim is being used to offset losses in refining and marketing.

Independent refiners and markets see in this situation, the report states, a constant threat to their operations so long as it is possible for some integrated companies to use their crude oil profits to cover losses in refining and marketing. They contend that profits made from production should not be allowed to be used in other branches of the industry, but should be separated therefrom by divorcement of production from other branches of the industry.

Some of those who have written the committee believe that simply divorcing production from the rest of the industry would be sufficient; others maintain that production and pipe line operations should be divorced from each other and also from refining and marketing, while some believe that refining and marketing should be allowed to remain together.

Uncertainty of Control

It is pointed out by the committee in the report on the production of crude that there has not been a definitely assured continuous balance of supply with demand for crude petroleum, and that such a balance must be in effect as well as the selling of low cost crude oil by integrated companies in the form of refined products at less than the posted market price for crude oil must be prevented if a high enough average crude price is to be maintained to keep stripper wells in operation. Uncertainty of control over supply has been most detrimental, the committee reports, while domestic production allocations set by the federal agency have been too large.

"Hot" oil, excess imports, excess production of crude oil and gasoline have prevented a definite assured continuous balance of supply with demand, the report charges. This has resulted in supply exceeding demand from time to time. Failure to have effective control and the continued possibility of a breakdown in the control of the supplies, the committee states, makes impossible the assurance of a balance of supply with demand, all of which creates an increased willingness on the part of some fully integrated companies to sell their low cost flush production in the form of refined products at prices which net them less than the market price for crude oil, the committee contends, but which returns them a profit on their entire operations.

The committee found the allocation of production quotas within the states has not always been such as to promote the conservation of petroleum resources in pools of settled production, but on the other hand, they say, if such policies had been carried out they would tend to discourage the use of profits from low cost flush production to subsidize unfair marketing practices.

Report on Refining

The report on refining states the independent refiners complain they have been doubly injured under the code. In the first place, they state, refinery operation costs have been increased so that to come out even they would have had to get an increased spread between the cost of crude delivered at their refinery and the value of the refined products which they sell, but instead of this spread being increased, they complain the exact opposite has been the case. The price of crude, they say, has been kept artificially at a level far out of line with the wholesale market value of the refined products.

It has also been impossible to realize even the published spot prices for their gasoline, they say, due to the depressing effect of retail price wars upon the net realization back at the refinery. Refiners point out they must give some protection to their distributors to compete with the major companies and to keep their customers in business.

In support of the contention that refiners are losing money the committee states that it is their belief that practically every refinery east of the Rockies is operating at a loss. This is arrived at by the fact that a considerable number of companies reported to the committee, mostly from nonintegrated refiners, but some from companies engaged in other lines of the industry as well, all which showed substantial refinery losses since the advent of the code.

There appears to be a widespread belief in the industry, the report says, especially

(Continued on Page 136)

Completion by Pressure Control in Fitts Pool Permits Accurate Logging

By L. G. E. BIGNELL
Petroleum Engineering Editor

E. H. Moore's No. 4-B Smith location in Fitts Pool while well was being drilled in by surface pressure control methods

When cable tools are used for drilling oil or gas wells it is the usual practice to penetrate the producing formation slowly and only to a depth necessary to secure the desired production of oil or gas. Experienced cable tool drillers will feel their way ahead when drilling into a formation and may drill only a few inches or feet at a time and then bail and check the results of drilling. In this way it is possible to complete the well without taking in too much or too little of the formation and as samples are secured at frequent intervals accurate logs of the section penetrated are secured.

Good logs of producing formations have not been the rule with cable tool completed holes, however, because the driller has never recognized the necessity of saving all of the sample, instead of the sand only. When the bailer is run and the mud and coarse cuttings recovered a sample is dumped into a bucket and then washed. The object of the washing, usually done with water under considerable head, is to remove the mud and very fine material and recover the coarser cuttings and sand.

This practice has resulted in logs of cable tool wells usually stating the depth of penetration of the hole below the bottom of the casing shoe rather than indicating the proportion of fine material to coarse cuttings in the section. Cable tool coring is done in some instances and gives better results, but even when the core barrel is used frequently little or no attention is paid to the fines.

As a result of this poorly logged producing sections in the older wells it is now very difficult to determine the best methods of making repairs or increasing production. In many fields aditional wells have been drilled and carefully completed using either cable tool core barrels or by frequent bailing and recovery of all of the sample. This is done by permitting the material brought up in the bailer to settle and then decanting the water and analyzing the solids to determine proportions of sands and limes to shales and softer sediments.

With rotary tool completions much the same procedure has been followed in so far as the saving of the fine samples is concerned. Coring is probably more common with rotary outfits than with cable tool drilled wells, but too frequently only the coarse portion of the sample is saved and the results are unsatisfactory because the character of the entire section penetrated is not known.

Pressure Control at Well Head

During the week of March 11 a well in the Fitts Field was completed using the well head control and high pressure separators system while drilling into the producing formation. This method was followed in completing E. H. Moore's No. 4-B Smith well in Section 25-2-7 on the west side of the Fitts Pool. The work was supervised by E. V. Foran, consulting engineer of the firm of Parker, Foran and Knode of Austin and Big Lake, Texas.

On page 34, The Oil and Gas Journal of January 3, 1935 there is an illustrated article by the writer that describes similar work done by Mr. Foran in the Big Lake Field. Reference is made in this article to two papers presented by Mr. Foran. The method followed in Big Lake was used in completing No. 4-B Smith in the Fitts Pool and will be followed in completing future wells in that field.

The importance of this work cannot be overstated. The old method of drilling into a producing formation with the hole loaded with mud has resulted in many wells having erratic producing rates and in some instances all or nearly all of the producing formations have been clogged with mud and water or both.

In the Fitts Pool bottom hole pressures taken March 2 range from 1,425 to 1,850 pounds. The low pressure well is one at the north edge of production in Section 25-2-6e while the 1,850 pound pressure is reported in Moore's No. 3 Wirick in Section 29-2-7e on the east edge of the field. The wells produced from 2,140 bbls. to 9,813 bbls. during the period February 11 to March 2. The average loss in bottom hole pressure is reported as .7 pound per 1,000 bbls. of oil produced for that period.

These data present many points for consideration and when taken with the geological features of this field indicate that the formation pressures are not sufficiently high to permit drilling in with mud or washing in with water. A clear water column 4,200 feet high will exert a pressure of 1,822 pounds at its base. Mud weighing 10 pounds per gallon will have a specific gravity of 1.20 and will exert a pressure of 2,187 pounds per square inch for the same height of column.

New Hook Up

Two wells have been completed by this special method of drilling in, they are No. 4-B Smith well and No. 2 Schaurer in Section 29-2-7e. This second well is on the east side of the field where few completions have been made around it and its response will be followed with much interest.

On No. 4-B Smith the hole was drilled to the top of the Viola with the usual rotary outfit. The turntable was then removed and in its place the Hydril table and hydraulic feed substituted. Flush joint 3½-inch diameter drill pipe was used and Hughes 3-cone self lubricating bit. The string of 7-inch casing was set and cemented at 3,814 feet and the hole below this casing is 6¼-inch diameter with practically no caving.

The slush pump speeds were varied to suit drilling conditions and the proportion of gas added to the water reduced the water to an average weight of about 5 pounds per gallon. This weight water exerted a pressure of about 1,140 pounds per square inch at the base of the 4,200 foot string of drill pipe. With the formation pressure estimated at 1,850 pounds this created a differential in favor of the formation of about 700 pounds per square inch. Using mud the differential would be about 337 pounds in favor of the mud column against the formation.

With the Hydril turntable and hydraulic feed the drill pipe is sealed at the casing head. Four-inch pipe connects the well with a National Tank Co. 30-inch diameter high pressure oil and gas separator tested with cold water to 2,000 pounds and good for a working pressure of 1,000 pounds per square inch. This separator permits all cuttings to be dropped as the flow from the well passes through it. The velocity of the gas and water making up the stream from the well is so greatly reduced that the cuttings, which were not coarser than a grain of rice and ranged from that size down to 200 mesh sand, dropped out of the stream while the gas, oil and water passed on to the second separator set to work against lower pressure than the first separator.

By this system of handling the material from the well as the drill penetrated the formation it is possible to select samples at any time. The cubic

Engineering party at E. H. Moore's No. 4-B Smith well while drilling in with Hydril outfit. Left to right: Levi Ackley, Superintendent; E. H. Moore, Fitts Pool; Emery Finefrock, Murray Tool & Supply Co.; A. C. Outlaw, driller; Chas. P. McGaha, geologist; K. R. Teis, petroleum engineer; E. H. Moore; R. W. Simpson, Jr., consulting geologist, Ada, Okla.; E. V. Foran, consulting engineer, Parker, Foran and Knode, Austin and Big Lake, Texas, and Al Hicks, engineer, Hydril Co.

contents of a 6¼-inch cylinder is .2131 cubic feet per foot of length.

In drilling-in on this well samples were taken every 30 minutes and the drill penetrated between samples from 2 to 10 feet of material ranging from Viola limestone to Dense Simpson lime and Bromide quartz sand. Limestones have a weight of about 165 pounds per cubic foot; dolomite about 181 pounds and sandstone 110 pounds. For each foot penetrated in a 6¼-inch hole the weight of the material removed based upon the above average weights per cubic foot would be—limestone 35.1 pounds, dolomite 38.5 pounds and sandstone 23.4 pounds.

Under these conditions the amount of material delivered into the separator every 30 minutes varied from 50 to 385 pounds depending upon the rate and type of material penetrated. This is a relatively small quantity of material but it was all clean and under this system of controlled drilling it is possible to completely empty the bottom of the separator after each drilling period and definitely check the zone from which the sample is drilled.

By marking the Kelly drill stem the depth of the hole drilled between sampling periods is definitely known. Also the type of indicator used with the Hydril hydraulic feed permits the driller to note the rate of penetration quite closely.

One interesting feature of this work was the entire lack of caving. The type of formations penetrated were hard enough to stand well although in one section of the hole the bit penetrated about 3 feet in 3 minutes—and this section was noted to be very productive when tested and every one who saw the samples stated they were the best and cleanest ever recovered from a hole in that area.

By this method it was possible to make a chronological log of the section penetrated and from the top of the Viola found at 3,780 feet to the top of the McLish where the hole was bottomed at 4,330 feet every foot of the open hole was logged each day and all showings tested as penetrated.

Chronological Log

In the ordinary method of drilling in with rotary the returns are washed out with a considerable volume of fluid which may be mud, water or oil. Usually the returns are conducted direct to the slush pit and only small samples caught from time to time at the discretion of the driller or geologist assigned to care for this detail.

With the pressure control system the separator is flushed and the entire flow from well can be caught if desired and then the sample can be cut down by the use of any approved method, but preferably by the use of the sample splitter for cutting ore samples.

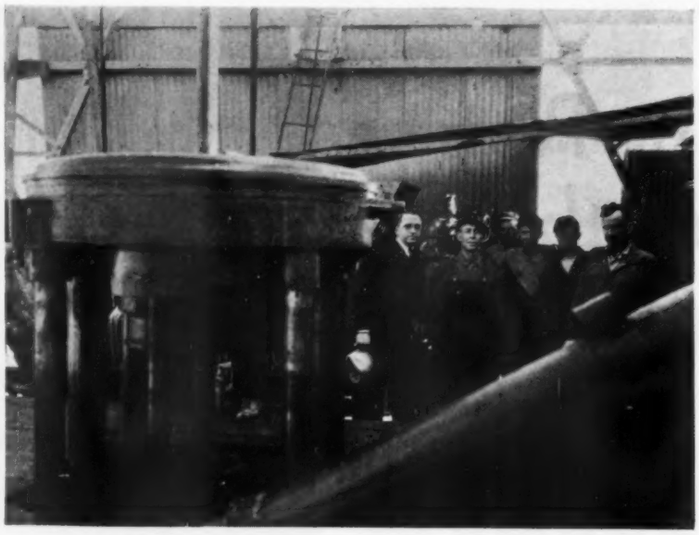
Watching the pressure gauge on the first oil and gas separator connected directly with the casing at well head it was noted when this change in drilling speed was reported by the driller it was immediately followed by a flucuation of the pointer in the pressure gauge on the separator. This effect was brought about by the concussion due to the sudden release of gas and oil under approximately 1,850 pounds pressure. The shock traveled up the annular space between drill stem and casing and caused the pointer on the spring gauge on the separator to fluctuate for a few seconds.

That fluctuation was pronounced enough to allow observers to predict that within 12 or 15 minutes the effect of drilling into this soft sand section would be recorded in the separator. This prediction was fulfilled for in about 15 minutes a slug of oil and gas entered the separator and the pressure gauge registered increased pressure. This indicates a velocity of fluid and gas flow of about 280 feet per minute but it must be remembered that the path taken in the annular space was probably effected by the rotary motion of the drill stem, as well as retarded by friction.

To test this formation the pumps were shut down and the drill bit lifted about 6 inches above the top of the soft sand section and the well allowed to stand in that condition for about 15 minutes and the rate of flow noted.

When the drill stem was lifted and the pumps shut down the formation pressure had little back pressure exerted against it by the weight of the fluid column and therefore could flow freely. This method of testing formations and showings was followed as each change was noted through check of drilling speed and pressure gauges.

When the bit penetrated into a virgin formation that was charged with gas and oil under relatively high pressures, the gas escaped so rapidly that a slight concussion or shock was transmitted in a wave like motion up the column of gas-cut water in the annular space in the hole and registered on the oil and gas separator pressure gauge. This feature of drilling in and using a fluid column that exerts less than formation pressure at the bottom of the hole permits productive zones to empty their contents quickly into the hole. The rate of flow is regulated by the differential maintained between fluid column and formation pressures.



Turntable and hydraulic controls used to drill in E. H. Moore's No. 4-B Smith well, section 25-2-6e Fitts Pool, Okla. Total depth 4,330 feet

Pressures

In completing a hole with well head control it is essential that the formations penetrated will stand without excessive caving while drilled.

It was noted that when the drill penetrated producing formations, gas under pressures of approximately 1,850 pounds per square inch was released into the hole, and created high velocity currents in the annular space between drill pipe and casing and blew the gasified water up the hole at such a speed as to increase the rate of discharge from the bottom of the drill pipe so the water was actually sucked out of the standpipe.

None of this water entered the formation. It served only as a cooling medium for the bits and to carry the cuttings up the hole. When drilling in barren formation without the aid of energy produced by high pressure gas escaping into the hole from producing stratas that had been penetrated the flow of 5-pound water was sufficient to carry the cuttings, that were not coarser than grain of rice or wheat size, to the separator on the surface where the cuttings were dropped and any gas or oil that accompanied them was carried over into the second and third separators where they in turn were captured.

Advantages of System

The marked advantage of the system is the accuracy of control possible at all times while the bit is penetrating into the zone that should be productive if the well is to be commercially successful. In completing Moore's No. 4-B Smith geologists and drillers familiar with the Fitts Field were surprised to find that there was productive stratas in the Viola lime that were quite definite in character, also that sections of the Bromide formations below the Viola showed well saturated sands previously assumed to contain only water.

This water noted in the sand samples was probably drilling fluid for it was not salty and did not cause trouble in producing the oil. Because of the pressure exerted by the column of mud fluid used in drilling in the water had been squeezed out and the sand grains wetted. How much of the water actually entered these porous streaks in the formation is difficult to estimate, but it is known that when the wells were brought in by washing with fresh water it took some time to get them to produce clear oil.

The pressure control system of completing wells has many advantages and it may be applied in any hole where the formations stand well and do not cave because if the walls of the hole sluff off the relatively small volume of water used will not carry the cavings and cuttings to the surface fast enough to keep the hole clean.

Using this method of drilling in it is possible to prepare a daily log showing the formations penetrated and their individual capacity to produce. This type of log informs the executive of the company exactly what is going on at all times and permits the production department to make prompt decision as to where the drilling should stop. The record is very valuable for future work in the bottom of the hole and this feature in itself is so important that it alone justifies the use of the well head pressure control system.

Western Petroleum Refiners Association Announce Program of Annual Meeting

A memorial service for Howard Bennette, deceased president of the Western Petroleum Refiners Association will immediately precede the calling of the twenty-third annual convention of the association at the Elms Hotel in Excelsior Springs, Mo., on April 4 and 5. Services will start at 10:30 Thursday morning and will be in charge of George D. Locke, vice president of the Barnsdall Oil Co., and W. R. Boyd, Jr., executive vice president of the A.P.I., will deliver the memorial address. For some time after Mr. Bennette's death members of the association were undecided whether to postpone the annual meeting and to hold only the memorial services, but at a meeting of a number of the executive committee in Kansas City on last Friday it was definitely decided to carry out the original plans so far as practical.

The program of the regular meeting calls for opening of the convention Thursday afternoon at 2 o'clock by H. T. Ashton, president of the Lubrite Division of the Socony-Vacuum Oil Co. and senior vice president of the association, who will also preside.

The convention will also provide for the choosing of a new president for the association. The names of several men within the ranks of the association have been mentioned as successors to Howard Bennette in that office, but it will remain for the executive committee meeting in Excelsior Springs to make a definite announcement.

The meetings will be carried on through Friday and have been arranged as follows:

Program, Twenty-third Annual Meeting,
WESTERN PETROLEUM REFINERS ASSOCIATION
Elms Hotel, Excelsior Springs, Mo., April 4-5, 1935

Opening Session, Thursday Afternoon, April 4

2:00 p.m. Appointment of Resolutions and other committees.
"Stabilization," by H. T. Ashton. Discussion.
"The Petroleum Code and Refining Operations," by E. B. Swanson, Economist for Bureau of Mines and Member of Petroleum Administrative Board. Discussion.
"Washington Problems," by Fayette B. Dow, Washington Counsel, American Petroleum Institute, National Petroleum Association and Western Petroleum Refiners Association. Discussion.

5:00 p.m. Meetings of Committees on Octane Brackets, Tractor Fuel and Road Oil.

Friday Morning Session, April 5

9:30 a.m. C. L. Henderson, Vice President, Vickers Petroleum Co., and Vice President, Western Petroleum Refiners Association, presiding.
Business session of Association.
Appointment of Nominating Committee for officers and directors.
Report of Tractor Fuel Committee.
Report of Octane Brackets Committee.
Report of Road Oil Committee.

Friday Afternoon Session

1:30 p.m. Roy B. Jones, President, Panhandle Refining Co., and Vice President, Western Petroleum Refiners Association, presiding.
"Posting Tank Car Prices," by R. W. McDowell, Vice President, Mid-Continent Petroleum Corp. Discussion.
Report of Resolutions Committee.
Report of Nominating Committee.
Election of officers and directors.

High Vacuum Distillation Apparatus Developed for Testing Heavy Oils

By O. C. BLADE
U. S. Bureau of Mines[1, 2]

When heavy oils such as lubricating stock, residues, or topped crude oil are analyzed, distillation under reduced pressure is one of the methods employed. During the study of the properties of a reduced Mid-Continent crude oil and its distillation products from a vacuum unit the problem arose of cutting deeper into the oil than was possible by the Bureau of Mines Hempel method.[3] By this method the reduced crude is distilled from the Hempel flask under an absolute pressure of 40 mm. mercury to a temperature of 300°C. (572°F.) The vacuum distillate receiver, which was developed by the Bureau, is quite satisfactory at pressures of 40 mm. mercury or higher but at lower pressures tends to leak because the actuating device for rotating the test-tube rack operates through a stuffing box. The Hempel flask is also open to objection for distilling heavy oil at low pressures because its long neck and narrow side arm are a hindrance toward vaporizing and recovering the heavier cuts obtainable.

TABLE 1—APPROXIMATE SUMMARIES OF A REDUCED MID-CONTINENT CRUDE OIL DISTILLED AT DIFFERENT PRESSURES

	Distillation A (5 mm.)		Distillation B (1 mm.)		Distillation C (40 mm.)	
	Percent	Sp.Gr.	Percent	Sp.Gr.	Percent	Sp.Gr.
Gas oil	22.0	0.849	25.0	0.850	23.5	0.842
Nonviscous lubricating distillate	20.2	.868	18.2	.870	18.1	.862
Medium lubricating distillate	11.2	.882	10.6	.884	12.6	.880
Viscous lubricating distillate	35.6	.900	40.2	.904	4.6	.889
Residuum and loss	11.0	.961	6.0	.979	41.2	.928

Laboratory Apparatus

With the idea of incorporating the desirable features of the Hempel method and eliminating or modifying the undesirable ones the following apparatus and method were devised.

Receiver: The distillate receiver (Figure 1) is a glass cylinder 12 inches high, and 6 inches in diameter clamped between two metal plates. A circular rack in the upper portion holds 10 graduated test tubes which can be placed each in turn under the tip of the condenser which projects into the receiver through a rubber stopper. The actuating device for rotating the rack is an electromagnet and a system of ratchets which are contained in the bottom portion of the receiver itself. Wires from the magnet lead to a switch and storage battery outside the receiver through two sealed holes in its base. This device eliminates the need of a stuffing box.

Flask: A 500-cc. distillation flask of the Hempel type was modified by shortening the column to 6½ inches and blowing on a new side arm approximately ⅜-inch inside diameter about 2½ inches below the top. This larger side arm was attached because it is believed that the heavier vapors are less retarded in their passage from the surface of the boiling liquid to the condenser if there is no constriction to raise the pressure between the source of vacuum, namely, the pump, and the surface of the liquid. Also the point has been made that during distillation at a pressure of 10 mm., drops forming on the end of the side arm momentarily raise the pressure in the flask and the fluctuation often causes violent boiling with spattering of tarry material over into the clean cuts of distillate.[4] Several devices have been used to avoid this difficulty, but by the use of a side arm of larger diameter, the writer has had no difficulty on this score, since it is impossible for a drop of liquid to close the tube completely.

A bulge was blown around the neck of the flask, converging to the outlet arm. The bulge continues the angle of the side arm, which is somewhat sharper than on the regular Hempel. The purpose of the bulge is to guide the reflux from above down to the outlet tube rather than have it run down to condense some of the heavier vapors ascending. The writer believes that excessive refluxing by condensed vapors from above the side arm hinders the recovery of the heavier vapors. The purpose of this apparatus is not so much to make a sharp fractionation of the heavy oil but to get as much of it vaporized and past the side-arm inlet as possible, at the same time recording the temperature of those vapors.

Flask Insulated

The flask is insulated with a permanent jacket of asbestos magnesia material plastered onto a thickness of ½-inch and allowed to dry. Two glass rectangles set in the insulation on both sides of the neck in the region of the bulge provide a window with dead air space for observing the action at that point. The jacket can be conveniently transferred to another similar flask in case of breakage simply by sawing it vertically in half and replastering the seams with a little fresh material. The side arm is also insulated.

In the neck of the flask are two cones of coarse wire gauze. An accurate A.S.T.M. high-distillation thermometer is set in the top of the flask according to A.S.T.M. method D-285 33. A rich paste of litharge and glycerin over the cork usually makes a tight joint. At high temperatures this material becomes brittle and cracks, but a thick syrup of flake shellac and alcohol applied when the litharge has dried makes an effective seal.

Condenser: A three-bulb glass condenser of the type described in Bulletin 207[3] is used. The side arm of the flask just fits loosely into the top, extending in about three inches and is made tight by a sleeve of strong red-rubber tubing which slides over the condenser top. A little of the thick shellac on the edges of this sleeve stops the leaks. Due to deterioration of the rubber with heat it is usually necessary to put on a new one for each distillation. The condenser is lagged with chromel resistance ribbon connected to a rheostat and switch on a control board. A glass jacket is held in place around the condenser by means of corks.

Pressure Regulator

To maintain the desired pressure without fluctuation air is bled into the system from a partially evacuated chamber. (See Figure 1). The set-up for accomplishing this is as follows: The receiver is connected to the pump by a ⅜-inch inside-diameter tube. In this line is a tee with a connection to a capillary tube beyond which is a large glass jar or surge chamber. One tube from this chamber connects to a glass stopcock on the receiver. Another tube connected to the surge jar is stopped with a glass tip, which opens to the air and has a fine jet. The size of this jet, together with the setting of the stop-cock in the line from surge jar to receiver, regulates the pressure in the system. Air, bleeding through the jet into the surge chamber, prevents the pressure there from getting as low as in the receiver but still allows a fairly low pressure and, by bleeding into the receiver through the stop-cock keeps the pressure in the system at a given point. By this means the pressure of the system can be brought to a given point and maintained there without any difficulty. This method of bleed-in from a relatively low pressure instead of directly from the atmosphere has proved very dependable.

Other Apparatus

A vacuum pump, an electrical heater for the flask with rheostat and switch, and a mercury manometer complete the equipment. A Hickman vacuum gauge[5] has been connected to the system recently and is proving very valuable as a means of detecting leaks, since a slight change in pressure is easily noticed on the butyl phthalate manometer.

Test Procedure

Procedure: 300 cc. of the oil are weighed into the flask, based on the specific gravity at 100°F. This figure is used, since it has been determined that the average temperature in the receiver during the period of distillation is about 100°F. (volumes are read at this temperature). A piece of unglazed tile is added, the cones and thermometer adjusted, the flask clamped in place over

(Continued on Page 133)

[5] Hickman and Weyerts, The Vacuum Fractionation of Phlegmatic Liquids: Journal American Chemical Society 52, 4714 (1930) Appendix p. 4728.

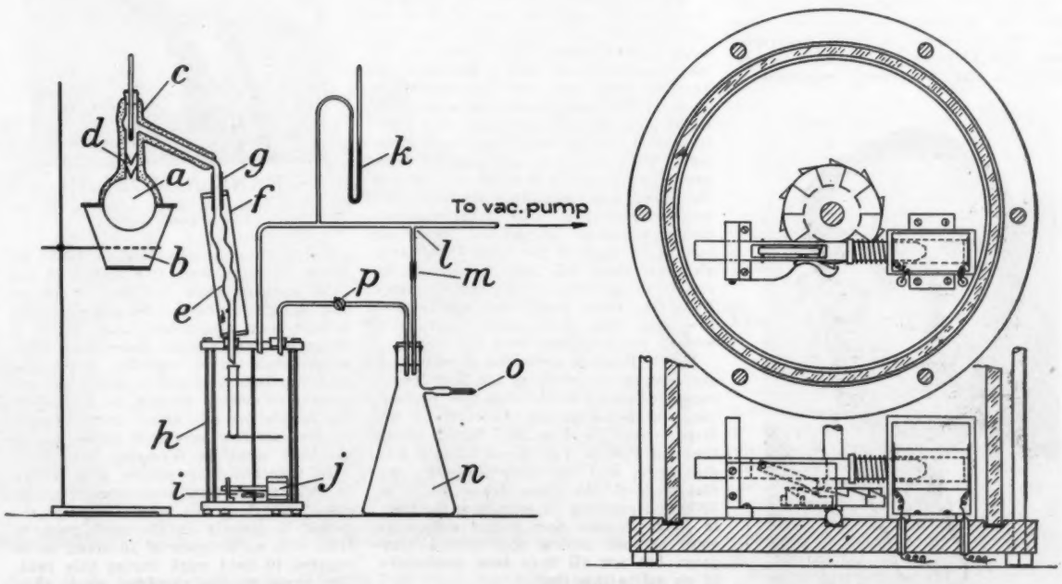


Fig. 1—High vacuum distillation apparatus: (a) 500 c.c. flask, (b) electric heater, (c) insulation, (d) wire gauge cones, (e) condenser, (f) gasket, (g) rubber sleeve, (h) receiver, (i) rachets, (j) electromagnet, (k) mercury manometer, (l) tee, (m) capillary, (n) surge chamber, (o) bleed-in jet, (p) stop cock

[1] Published by permission of the Director, U. S. Bureau of Mines. (Not subject to copyright).

[2] Refinery operator, U. S. Bureau of Mines Petroleum Experiment Station, Bartlesville, Okla.

[3] Dean, E. W. and others. Analytical Distillation of Petroleum, Bureau of Mines Bulletin 207, pp. 10-23.

[4] Gavin, M. J. and Foster, A. L. Apparatus for Vacuum Distillation of Lubricating and Heavy Petroleum Oils: Report of Investigations 2819, Bureau of Mines, July, 1927, p. 2.

Annual Geological Meeting Papers Reflect Industry's Need for Reserves

By L. G. E. BIGNELL
Petroleum Engineering Editor

WICHITA, Kans., Mar. 23.—The twentieth annual meeting of the American Association of Petroleum Geologists has just been completed here with an attendance of more than 1,150 registered members and guests and probably half as many more interested persons attending some of the meetings. A large percentage of the visiting geologists were accompanied by their wives and this may be taken as a criterion as to the prosperous condition of this group and their prosperity is a guide to the activity of the industry in seeking for more oil reserves.

In his address as retiring president of the association, W. B. Heroy, chief geologist for the Consolidated Oil Corp., New York City, stressed the need for more accurate estimates of oil reserves and said that he had "come to believe that the work of preparing such estimates and of making them as reliable as possible must be squarely accepted as one of the obligations of the geological profession."

The many prepared papers that were presented before the three days' session outlined quite clearly that the geologists, geophysists and paleontologists are busy in the first portion of this task, that of finding the new reserves of oil so necessary to replace the oil being used from the fields found some time ago. Symposiums of present activities in the principal producing provinces of this country and review of the geophysical work done in the United States and abroad all clearly indicated the search for oil is very active, and also emphasizes the more important fact that the new discoveries made to date have not been in keeping with the depletion of the older pools.

Doctor Heroy further stated in his address that "It should be made very clear that the oil supply of fields discovered more than 10 years ago has been largely exhausted and the present requirements of the industry for crude oil are being supplied chiefly from more recently discovered fields.

E. C. MONCRIEF
Secretary-Treasurer, A.A.P.G., Derby Oil Co., Wichita, Kans.

"With the continued testing of the remaining wildcat territory and the increased difficulty of finding new pools the question as to how much oil remains in the ground will become more and more acute. Instead of occasional demands for estimates of petroleum reserves in periods of fear and shortage, the industry, the Government and the public will soon expect annually revised statements of our petroleum reserves. These will take into account not only producing fields but also prospective areas and will consider all new discoveries and all newly gained experiences as to how much oil can be recovered.

"Close constant study of the problem will gradually increase the accuracy of the basic data and the results will in consequence become more dependable."

Geophysical Activity

One of the interesting sessions to the oil man was that held by the Geophysics Division on Friday morning which ended with a symposium of the geophysical activities throughout the United States and some foreign countries. The first speaker was Dr. Joseph L. Adler, who reviewed the work done along the Gulf Coast of Louisiana and Texas during the period August, 1933, to January, 1935. Since October, 1934, there has been an average of 43½ seismograph instruments employed in this district monthly. The minimum activity was during the period October-November, 1933, when only 25½ instruments were in use. The half instrument was one instrument used two weeks.

Torsion balance activity for the same period based upon the use of three instruments to each crew was at a minimum in November, 1933, with only 76 instruments in use and a maximum in January, 1934, with 109 torsion balances used. Other instruments used in the Gulf Coast area were one pendulum, two gravity meter parties, and four magnetometers. The refraction seismographs were used experimentally in 1934 but most of the work done was with the reflection type seismographs. This is the predominating type of geophysical surveying now being done in the Gulf Coast area although there has been a marked decrease in geophysical exploration since February, 1935, mostly due to the fact the area has been quite thoroughly worked prior to that time.

H. B. Peacock presented a review of the seismograph work in the East Texas region which he divided into two periods, the first following the discovery of the Boggy Creek Field in 1927 during which the Van Pool in Van Zandt County was discovered, and the other following the discovery of the East Texas Field in 1930 and reaching its maximum intensity in 1932. Several deep seated structures were mapped during this second campaign but not all have been productive of oil up to this time.

The major oil companies' parties are using the reflection seismograph methods and have found the Georgetown formation a good marker. If deeper drilling in this area discovers oil in the Trinity formation it is probable it will be reworked using a deeper horizon for a marker.

The score of discoveries in this region has been three fields producing oil or gas on structures mapped by geophysics to four fields opened without the use of geophysics. This is largely due to the fact that this area has not previously lent itself well to this type of exploration but now that the geophysist has developed the technique of using the Georgetown formation as a marker it is believed structures found by this method will be drilled later. Until this exploratory work with the drill is completed it is thought the geophysical work will be less active in East Texas regions for a time.

Rocky Mountain Region

Dr. John H. Wilson reviewed the work done in the Rocky Mountain states and summarized results by states. Montana had no crews at work in 1934, but one crew has been in the field in 1935. In Wyoming there were five parties in the field in 1934 some detailing structures only partly exposed. The seismograph method was used mostly and stated in terms of crew months there were 11½ seismograph crew months, one-fourth magnetometer crew month and 1¼ crew months of electric method, as applied to the search for oil. Other crews searching for minerals have been active during the 1934 period in Wyoming.

FRANK A. MORGAN
Vice President, A.A.P.G., Rio Grande Oil Co., Los Angeles, Calif.

In Colorado four parties were active in 1934 and several structures were located and there has been a marked increase in activity in the early part of 1935 with an estimate of 10 crews to be engaged in field work during this year. The crew month averages were 17¼ seismograph, 3¾ electric method for oil, and 1¼ magnetometer. One portable drilling outfit equipped with a resistivity outfit has been engaged in oil work.

In Nebraska there were two seismograph parties in the field in 1934 with the discovery of three structures. One at Hay Springs is now to be explored with the drill as soon as deep coring work is completed. The other structures will also receive additional confirmatory work this year. The Nebraska crew month average was 10½ seismograph parties.

A. IRVING LEVORSEN
President, A.A.P.G., Tide Water Oil Co., Houston, Tex.

In South and North Dakota there has been no geophysical work done during the past year. Also none in Arizona for oil nor in Idaho or Nevada, but in Utah there has been two parties exploring for ore deposits in 1934 and a limited amount of work in the field for oil is to be done with one well to be drilled on a mapped structure this year.

The exploratory work in California has been limited largely to reflection seismograph parties according to Dr. Henry Salvatori, who reported for that state. Small companies have used magnetometers for some field work and one field party used the refraction method. There was an increase from three crews engaged in March, 1934, to 11 by the end of the year. During 1935 it is predicted there will be at least 15 crews in the field and two new crews have actually started work since January.

Geophysical work in California has been largely confined to the southern part of the state and limited to five areas there. They are San Joaquin, Sacramento, Los Angeles, Ventura and Santa Maria valleys and basins. Most of the work, nearly 90 per cent, done in the San Joaquin Valley, was limited to the south portion of the area and as a result of this work four gas fields were discovered. In the other areas it has been found that they have been mostly explored by the drill and the oil and gas fields discovered but on the whole the geophysical work done in California compares favorably with results in the Mid-Continent region. Considerable geophysical work using electrical methods is being carried on in California in search for ore bodies.

Dr. E. G. Leonardson reviewed the geophysical work in Europe and reported much activity, much of it being done by electric methods with good results. Torsion balances are also being used extensively in some of these areas. Russia has been very active in search for new structures during 1934 and has had some good results. Much of the area is comparable with the Gulf Coast region of this country.

Work has been done in Rumania, Poland and Morocco. Germany has done much exploratory work with the induction method especially in search of salt dome structures.

There is one new line of geophysical investigation receiving consideration in Europe based upon a study of the natural ground currents and their intensity

and direction of flow. This method does not contemplate the use of other than the natural currents in the earth's crusts and it is being applied to problems dealing with corrosion of buried pipe and for similar purposes. Another interesting use of geophysical methods is studying the effect of tide heights, vibrations and water pressures on piers and jetties extending out to sea.

Results Gratifying

The desire to find new oil fields in Mexico has led to the extensive use of geophysical methods according to Paul Weaver. This is also true of eastern Venezuela and other South American countries. The magnetometer, torsion balance and seismograph methods have been used and some gratifying results have been obtained not so much in mapping individual structures but in working out tectonic trends and it is along these trends that it is hoped future oil fields will be developed in Mexico. Some areas contain salt dome structures that have been mapped especially in the Isthmus of Tehuantepec where several fields were opened some years ago. The Tampico embayment is really an extension of the oil fields of the Gulf Coast of Texas and the first seismograph work in America was done in this area some years ago. The problems involved are quite complex and will require much additional study and exploration with the drill to determine whether there are other fields that parallel the "Golden Lane" so productive a few years ago.

G. H. Westby reviewed the work of Oklahoma and Kansas with a summary based upon crew months. In January, 1934, there were 16 and December 25 crew months of geophysical work in Oklahoma and Kansas, July was the high period with 12 crew months of work and in December it had decreased to 8 crew months. There were 16 companies represented in this work.

Work in Oklahoma has been largely concentrated in the area designated as the extension of the buried granite ridge of Kansas and northern Oklahoma and in Logan County there were 49 crew months in 1934 and up to March, 1935. No results as yet have been attained in finding new pools in this area.

Just at this time there is a great deal of activity in southeastern Oklahoma with seven parties in Pontotoc County and this has been occasioned by the discovery of Fitts Pool.

In Kansas there were five discoveries following considerable field work in Rice, Barton, Ellsworth, Russell and Reno Counties. In Oklahoma 10 new discoveries are credited to the geophysical work done before the area was drilled. Drilling has frequently been delayed for several years following the geophysical work as in Polo Field, Oklahoma, which was mapped in 1930 and actually drilled in 1934. Chandler, Oklahoma, was mapped in 1930 and drilled in 1934 also.

In the West Texas area there has been considerable work done in the Permian and Delaware Basins during 1934 according to O. C. Lester, Jr. This work

DR. L. C. SNIDER
Editor, A.A.P.G.

will continue during 1935 and an area of 30,000 square miles will be explored extending from San Antonio to Lubbock, Tex., and bounded on the west by Hobbs, N. Mex., and known as the Edwards plateau region.

One interesting detail has been developed in field work in this region in that standardized methods are used in drilling shot holes because many of them develop into surface water wells later and water is at a premium in this entire region and these water wells are later used either by drilling crews or turned over to the landowners for domestic or stock purposes.

Currently Active Fields

The symposium on active fields took up all of Friday afternoon and was most enlightening. Southwest Texas, South Texas salt domes, West Texas and North Central Texas were discussed. Southwestern Oklahoma, Fitts Pool, Kansas and Michigan also came in for their share of attention.

Differences in Gravity

In discussing Gulf Coast salt domes, Paul Weaver, of the Gulf Production Co., Houston, Tex., brought out an interesting point. In drilling salt domes that are progressively deeper towards the Gulf it has been found that the oil in the northern fields was of lower gravity and accompanied by less gas than the domes of the middle region, while the domes nearer the coast in the same producing formation as found in the first two classes of fields was largely gas bearing. This condition was not explained but it has been noted in several strips of this territory studied. It seems to limit the depth of oil producing formations in these formations to areas located at some distance from the coast but whether it will prove true in regions east and west of the salt dome area adjacent to Houston remains to be proven.

Dr. Hal P. Bybee, of San Angelo, outlined the work done in West Texas with a summary of wells drilled and discoveries made. This region has two types of producing fields, those that have lime and those that have sand producing horizons. The lime wells are usually acidized and this helps to increase their potentials considerably.

There is much work being done in North Central Texas according to M. M. Garrett of Wichita Falls, Tex., and it is believed some deeper producing horizons will be discovered as a result of it during 1935.

A. I. Levorsen, the newly elected president of the association, gave a very interesting discussion of Fitts Field, Oklahoma, and predicts that this area will be extended to include Sections 33 and 34-2-7e, also that much of the adjacent territory will receive deep tests during this year in hopes of finding additional fields in formations of the type that produce in Fitts Field.

Virgil Kirkham discussed Michigan as an oil state and showed there are several trends being worked there that have produced many pools since 1926 and which may be extended southeast or northwest, as well as other trends may be found paralleling them due to the extensive exploratory work now being carried on there.

Kansas is receiving much attention by the oil companies now according to Roy Hall, consulting geologist of Wichita, Kans., and 25 new pools have been opened since January, 1934, four of them having been discovered early in 1935. The new pools discovered west of Range 1 have added 286,086 bbls. to the daily potential of the state and as a result of these new discoveries the daily production is now the highest in the history of Kansas since oil was discovered there in commercial quantities in 1886. Most of these new pools have been opened in lime formations and the use of acid has materially increased the wells' productivity.

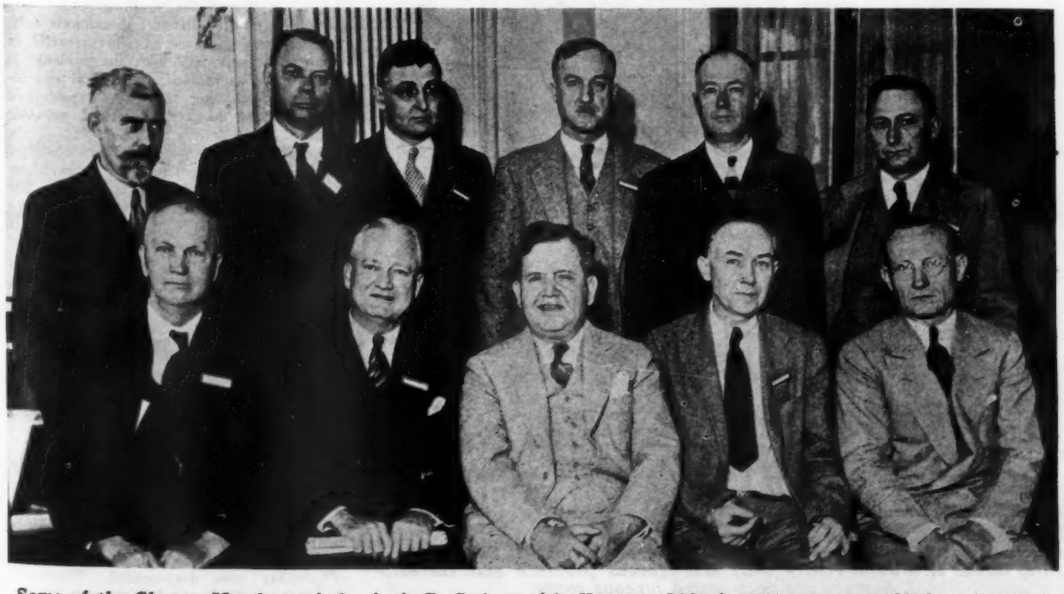
New Officers

To attempt to discuss the many excellent papers presented at the three days' sessions would require much space and it would be difficult to select any particular outstanding ones for all were of high order. Many papers dealt with subjects allied to oil production and it is noted that each succeeding annual meeting of the Petroleum Geologists deals more with these phases of activity.

The election of new officers was done by instructed ballot cast by the secretary as there were only one set of officers nominated and their election was therefore unanimous. They are A. I. Levorsen, of the Tide Water Oil Co., Houston, president; Frank A. Morgan, Rio Grande Oil Co., Los Angeles, Calif., vice president; E. C. Moncrief, Derby Oil Co., Wichita, Kans., secretary-treasurer, and Dr. L. C. Snider, Henry L. Doherty Co., New York City, editor. These men are all well known to their associates and their selection to guide the affairs of this association for 1935 is a happy choice. The executive committee will consist of this group with the retiring president, W. B. Heroy, Consolidated Oil Co., New York. J. P. D. Hull continues as business manager and the offices will be retained in Tulsa.

The other groups to elect new officers at this time were the Society of Petroleum Geophysicists and the Society of Economic Paleontologists and their selections follow: The Society of Petroleum Geophysicists elected B. B. Weatherby, Tulsa, head of the Geophysical Research Corp. and a director of the Amerada Petroleum Corp., president; L. R. Blair, of the Humble Oil & Refining Co., Houston, Tex., vice president; G. B. Westby, of the Seismograph Service Corp., Tulsa, secretary-treasurer, and C. F. Kammenstine, of the Independent Exploration Co., Houston, editor.

The Society of Economic Paleontologists and Mineralogists elected Dr. W. H. Twenhofel, head of the geological department of the University of Wisconsin and head of the geological department of the geological branch of the national research council, as its president. U. S. Grant, IV, of the geological department of the University of California at Los Angeles, was elected vice president; Prof. Gaylord Scott, of Texas Christian University, Fort Worth, secretary-treasurer, and Dr. Raymond C. Moore, of the University of Kansas, re-elected editor.



Some of the Charter Members of the A. A. P. G. formed in Norman, Okla. in 1916 were assembled at the Wichita annual meeting. From left to right, seated: Dr. Charles N. Gould, Norman, Okla.; Wallace E. Pratt, director, Humble Oil & Refining Co., Houston, Texas; E. L. DeGolyer, consulting geologist, Houston, Texas; Irving Perrine, Oklahoma City, Okla.; Alex W. McCoy, Ponca City, Okla. Standing: Dr. Ed Bloesch, president Tulsa Geological Society, Tulsa; Charles R. Eckes, Tulsa; Harry F. Wright, geologist, Tulsa; Jerry B. Newby, Oklahoma City, Okla.; Fritz L. Aurin, Southland Royalty Co., Ponca City, Okla. and Robert E. Garrett, Tulsa.

Trading in Futures on Commodity Exchange

NEW YORK, Mar. 25.—Gasolines futures opened unchanged to two points decline in trading on the Commodity Exchange today. Following the opening prices began to advance and the market closed three to eight points higher. Sales amounted to 210,000 gallons. June gasoline sold at 5.75 cents including 1-cent federal tax for June delivery.

Trading in gasoline futures has been more active over the past week.

Trading in crude oil futures has been less active. They opened today unchanged to one-half cent decline. Fractional advances were registered during the day and closing prices were unchanged in all positions. No sales were recorded.

Volcanoes of Northeastern Louisiana Account for Accumulation of Oil

By H. D. EASTON, E. M.

The north portion of Louisiana is divided into two geological provinces, dissimilar in all respects: they are wholly unlike in the formations from the surface down to the basement rocks (especially true below the base, or near-base, of the Midway), and in the mechanics and time element of their origin. This has a most important bearing on any prospecting for oil and gas, hence these major factors should be understood by any operator undertaking development work — more especially in northeastern Louisiana, southeastern Arkansas and western Mississippi.

North Louisiana, as a whole, has been called structurally the "North Louisiana uplift." Considered as a unit, this large uplift is something of a broad and long terrace bounded on its south by the Angelina-Caldwell flexure, or monocline. Located on the west end of this terrace is the Sabine uplift—a large anticlinal dome, about 100 miles in diameter, lying partly in Texas, which is punctured in places by sharp upthrusts; of uncertain formation column at any wildcat location, and responsible for many fields of oil and gas, including the wonderful East Texas oil field.

Much has been written and said about the Sabine uplift, but it seems probable that operators still think of it as a smooth, regular anticlinal fold with a definite makeup of beds to be penetrated by the bit. Many facts could be pointed out to dispel this assumption. For example, in the Bellevue oil field, some 15 miles east of Shreveport, the anhydrite series of the Glen Rose (Trinity) was punched up and truncated near the surface so that but a few feet below the Nacatoch the bit enters the Trinity red beds below the anhydrite. Another example is found in Pine Island, about 25 miles north of Shreveport, where the anhydrite lies almost immediately beneath the "Woodbine" pay of the Tokio formation.

This is enough to say herein regarding the Sabine uplift.

Eastward from the Monroe fault[1] the beds hold regular in their composition and general thickness from the surface down to the base, or near the base of the Midway. It is the attitude of these surface beds which gave rise to the idea of the "Mississippi River syncline," which idea is true only in connection with the very young, and surface beds, and leads to an erroneous conception so far as the oil operator is concerned. When the bit passes through the Midway (of varying thickness within this province) it may encounter any of the following beds:

Possible Beds

1. It may go into granite or other igneous beds such as tuff or actual flow-rock, and may fail to find any portion of either upper or lower Cretaceous.

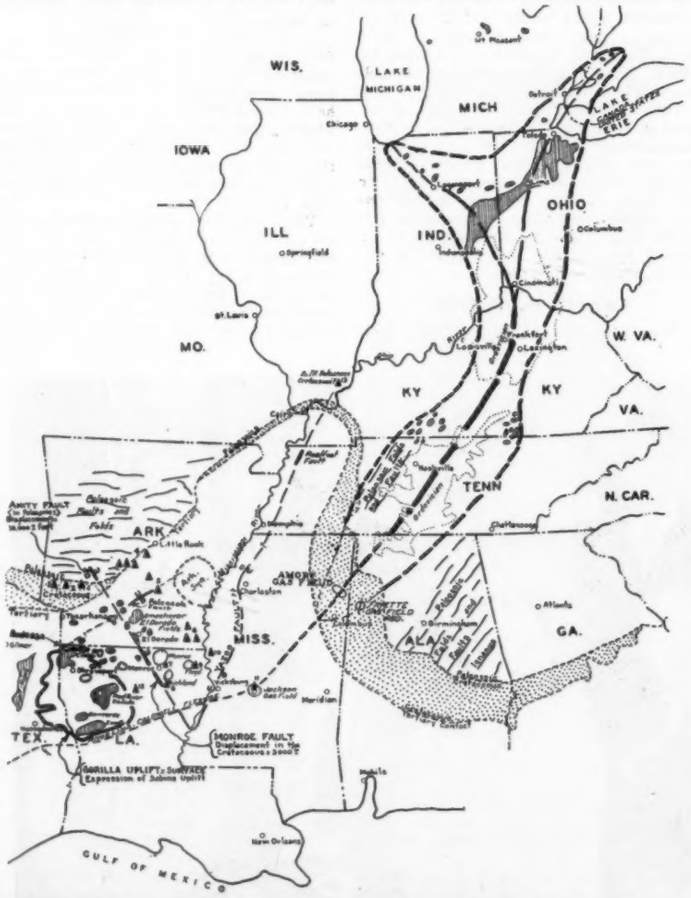
2. It may find the "gas rock," and then enter the igneous beds. This "gas rock" is something of a marl made up of whatever remnants of upper Cretaceous may have been deposited. It is not comparable to the Nacatoch, nor the chalk rock, nor any other beds on the Sabine uplift. This "gas rock" may produce oil or gas. More about it later.

3. It may find some "gas rock," next some Trinity red beds, and then enter the igneous rocks. Lenses of sand in these red beds may produce oil or gas. So far it is not known what portion of the Trinity is represented by these red beds.

4. It may find some member of the Paleozoics (Permian?) but I consider this quite doubtful so far as Northeast Louisiana is concerned, although highly probable farther north in eastern Arkansas. Of course, if the Paleozoics should be found, then their rocks could be encountered at any foot of drilling below the Midway just as is the case so far as now known in regard to the igneous rocks.

5. It might find the oolitic pay zone beneath the anhydrite series of the Glen Rose, as is the case in some portions of the Richland gas field.[13] However, in the Richland Field the lower Cretaceous beds stand almost on edge and seem to represent a portion of the Monroe fault itself. The principal pays in the Richland Field are shallower than this oolitic bed (from around 2,300 to 2,500 feet) and from four tuff beds lying more or less on top of the truncated beds. "The tuffaceous sand is loose and friable so that a well flowing into the air is in danger of cutting connections and bringing salt water into the producing horizons. Some wells outside the producing area have been failures probably because they were drilled at locations where the producing tuff beds are absent or lie below the salt water level."

The oolitic sand, beneath the anhydrite, is found at surprisingly shallow drilling depth in this part of Louisiana. This is due to the fact that the lower Cretaceous beds stand at such steep angle and thus elevated this Glen Rose pay to within less than 3,000 feet from the surface. It seems highly probable none of the anhydrite series will be found anywhere within this volcanic province east of the Monroe fault unless, like Richland, quite near the actual fault break.



Cincinnati arch and Angelina-Caldwell flexure showing: 1. Sabine (Gorilla) uplit. 2. Monroe-Amity fault and igneous province east thereof. 3. Surface and deep seated igneous rocks

Δ — **Volcanoes and Igneous Rocks within the Cretaceous. (1) Murfreesboro Volcano (Diamonds) Three vents. (2) Nashville Volcano. (3) Locksburg Volcano. (4) Group of Igneous (S.W. Little Rock). (5) Igneous Plugs (Found in Wells). (6) Same as 5 (S.W. cor. Ark). (7) Monroe Volcano. (8) Richland Igneous. (9) East Carroll Igneous. (10) Sharkey Co. Igneous. (11) Jackson Volcano. (12) Prothro Igneous on Salt Dome. (13) So. Illinois Volcanoes.**

Monroe Fault

From a point just west of Monroe, on westward to the Sabine uplift, the section of formations encountered in drilling are found rather constant and regular in composition and thickness. The Oil and Gas Journal reference given above[1] went quite fully into this matter. My Type Log, published as an insert in The Oil and Gas Journal of March 24, 1927, has the following footnote[14]: "The Woodbine formation is missing in the Monroe gas field and in the El Dorado-Smackover area—it need not be looked for eastward of these fields. A body of volcanic matter lies beneath the Monroe gas sand and below the so-called Blossom of El Dorado-Smackover. This volcanic matter rests on the lower Cretaceous beds. Deep drilling may find the Trinity. . ."

Volcanoes in the Cretaceous

I still have the discovery core, which came from Neighbors Oil & Gas Co.'s No. 2 Marlott, in Section 19-20n-6e, on the east edge of the Monroe gas field, July, 1923. This came from a depth of 2,334 feet and was identified by the U. S. Geological Survey as bentonite.[2] Accompanying this core of bentonite there was a fine collection of fossils which enabled the U. S. Geological Survey to say they belong to the "upper Cretaceous found in the Arkadelphia, Nacatoch and Marlbrook formations."[3] This information, plus the nature of the "gas rock," led to my calling the Monroe pay formation a marl representing a mixture of any remnants of these upper Cretaceous formations.

Likewise, I still have, among my collection of volcanic materials found in this general region, the first bentonite samples from Smackover. Early in May, 1924, the Traffic Oil Co. sent cuttings from their No. 1 Goodwin, in Section 20-16s-14w, Union County, Arkansas, from a depth of 2,864 to 2,916 feet. I reported this material as "clearly and obviously bentonite," and advised them not to look for any Woodbine, but stated they should go deeper in hopes of finding a pay in the Trinity. This, in passing, is the area where the new pay at Rainbow City is coming from the Trinity red beds, around 3,300-3,400 feet in depth.

Later in that year the Humble Oil & Refining Co. found material of the same nature in its Cordell well, in Section 1-18s-14w, Union County, Arkansas, from depths of 2,950 to 3,000 feet which was identified by the U. S. Geological Survey[3] " . . . it seems that metamorphic rocks have contributed little, but volcanic tuffs are the main source of the material in your specimens, although the evidence is not quite conclusive." The final conclusion reached was that these materials seems to be largely reworked volcanic tuffs.

From this evidence, and facts observed subsequent to that time, it became clear to me that these Arkansas conditions, like those in Monroe and Richland, outline the uplift side of the Monroe-Amity fault as shown on the accompanying map.

Since that time we have found it to be the rule to encounter volcanic rocks between Monroe and Smackover and throughout all the area eastward thereof to and across the Mississippi River. Some of these will be mentioned later in connection with the sketch map which has the major ones spotted thereon. (Cincinnati arch, etc., map.)

Monroe-Amity Fault

The Monroe fault was then clearly visible, with some 3,000 feet of displacement in the Cretaceous beds in the Monroe-Richland area. But, unquestionably, most of our important folds and faults in North Louisiana are but upper portions of similar ones deep-seated. Therefore the Monroe fault, so far as now known by drilling, is the expression of a deeper fault having still greater displacement. The Monroe fault is in agreement with a known Paleozoic fault which has a displacement that may amount to as

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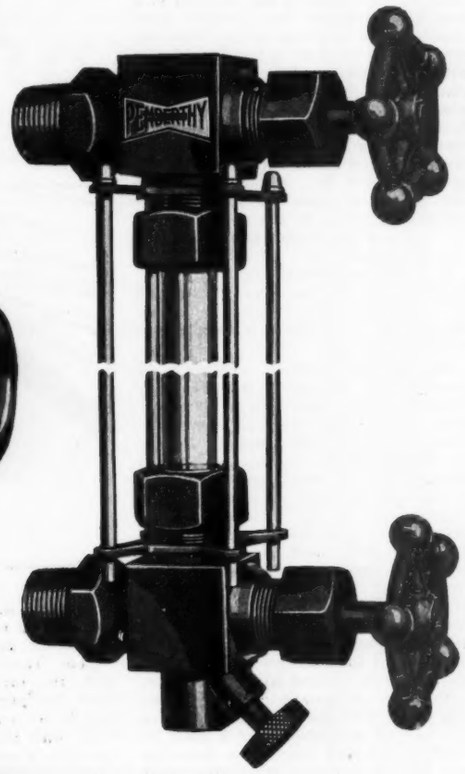

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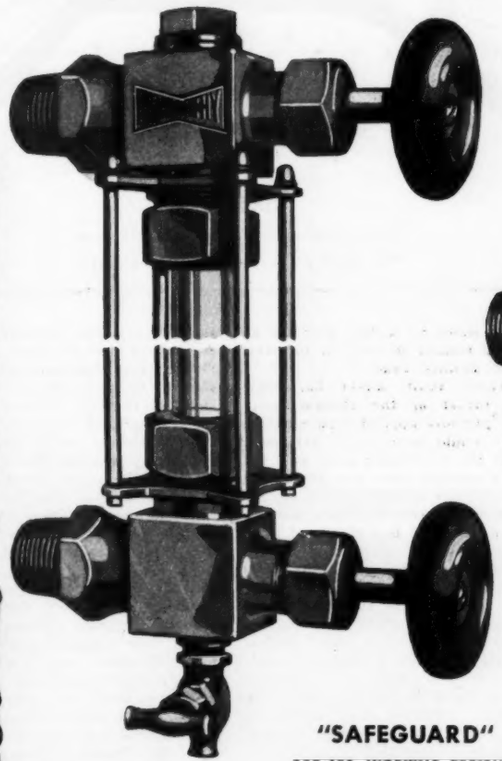

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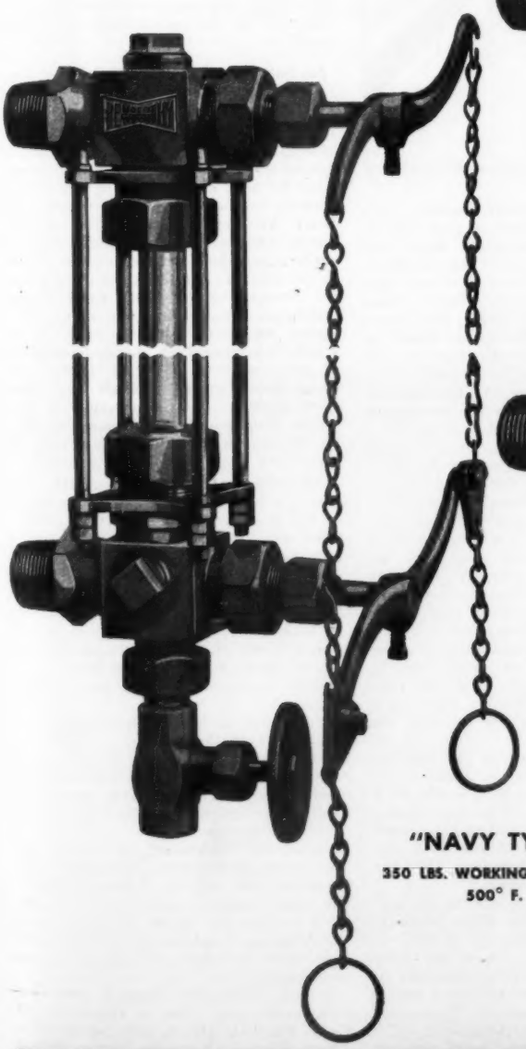

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much as 10,000 feet—part of which displacement is horizontal and not measurable. This Paleozoic fault lies almost at right angles to the normal trend of the many sharp folds and faults in the Paleozoics of southwestern Arkansas. As a general rule, faults do not so cut across the general trend in this manner, and the reason for this unusual course will be given later.

The Amity fault is located in the northeast corner of Pike County and the northwest corner of Clark County, Arkansas. Its course is approximately N 45° W, across Township 6s, Ranges 23 and 24w. It constitutes one of the main features of the cinnabar (quicksilver) district. It is described by Miser and Purdue[4]: "A cross fault, having a northwesterly trend and with its upthrow on the northeast side, is situated on the border of the Caddo Gap quadrangle east of Kirby. It truncates the east end of a syncline containing the Jackfork sandstone and the overlying Atoka formation, and the Stanley shale is brought up even with the Atoka, making a vertical displacement of at least 5,000 to 6,000 feet, which is the range of thickness of the Jackfork in the Caddo Gap quadrangle. How much greater the displacement is cannot be determined, but it may amount to fully 10,000 feet. Although the hade has not been observed, the fault is thought to belong to the thrust variety . . . much of the displacement may have been horizontal . . ."

In noting the general alignment of the Monroe fault and the Amity fault, each with so great a displacement, one should observe that the upthrow in each case is on the east side.

The earliest mention, so far as I know, of any faulting at Monroe is by Veatch,[20-21] who describes a "recent" displacement of 25 feet "just above Alabama Landing on the Ouachita River." He recognized the importance of this surface fault: It would quite naturally indicate the presence of a major fault deeper down. As the Monroe gas field was drilled up, it became evident that any major fault could not exist as pictured by Veatch's "Alabama Landing-Red River fault."

In 1921 the Louisiana conservation department[22] mapped a small fault in the eastern portion of the Monroe gas field and named it the "Monroe fault." Later[23] this fault was omitted from their maps. In these two references [22-23] are discussions of the Alabama Landing-Red River fault and the suggestion that it must lie farther north and nearer the Arkansas state line. However, it seems clear that lesser faulting—side faults—accompany major ones. There would be, quite naturally, lateral faults reaching out from the Monroe-Amity fault — something of a fault zone accompanying the major break.

Monroe Volcano

Not only had a new geological province been outlined, but coring in the Monroe gas field found evidence of volcanic material which must have come from some nearby vent. In 1929[6] the U. S. Geological Survey published a map showing the "Monroe volcano," along with several other volcanoes in Texas, Arkansas, Kansas and Illinois, all of which are in the Cretaceous.

Whereas wind-blown volcanic dust is widely known throughout the entire Gulf embayment region[7] we are not concerned herein with such deposits. Only igneous rocks in the nature of granites, tuffaceous material or flow-rock, which in turn have a direct application to the problem of structure, are of present interest.

Why of Monroe Fault

Refer to the sketch map and note that the Paleozoics are steeply folded and faulted in Arkansas and aligned nearly east-west. At places, such as the vicinity of Little Rock, they lie somewhat southeast-northwest. Then, similar folds and faults in the same age of rocks in western Tennessee align almost at right angles to those of Arkansas; they must meet and such junction will represent some intense compression. Note the Cincinnati arch (the first major structure west of the Appalachian ranges) and visualize the mechanical influence it had on the adjustment of the area lying between—the Mississippi River area.

There is subsurface drilling evidence of a north-south fault passing through the vicinity of Vicksburg, called the Yazoo-Reelfoot Lake fault with its downthrow near Vicksburg on its east side, probably reversed farther north so that the downthrow is on its west side.

This Yazoo fault, which skirts around the east margin of the Yazoo Delta (and outlines the easternmost extent of the meanderings of the Mississippi River) accounts for the abrupt break between the bottomlands and the hills. A Paleozoic fault so located would have some expression in the younger beds, and this in turn would outline how far the Mississippi River could have meandered in time past. Wells drilled east of the Mississippi River show that there is an abrupt drop similar to that on the west side of the Monroe fault.

This Yazoo fault would harmonize with the thrust of the Monroe-Amity fault. The pressure applied between these two faults would have begun far back, when both the Cincinnati arch and the Ouachita Mountains were new, and would have been applied steadily ever since. All of the beds within this Northeast Louisiana area would have had plenty of local faulting and buckling, ample opportunity for igneous intrusions, and the whole area would have remained rather high throughout much of the time devoted to the deposition of the Paleozoics and all of the younger beds. The most crushed region would have been Northeast Louisiana, where it is probable no Paleozoics will ever be found in any drilling. It is probable that relatively shallow drilling (less than 4,000 feet) will find igneous rocks in every test drilled.

The territory farther north, in Arkansas, has become a deep syncline, and it is probable that some Paleozoics are present. This syncline may be due partly to another Paleozoic fault (see sketch map) lying almost at right angles to the Monroe-Amity fault, with its downthrow on its south side. There may be such a fault[30] in the basement rocks, starting from a point between Camden and Smackover and extending northeast across Cleveland County. This may be but a side fault, but I think it a long basement fault at right angles to the Monroe-Amity fault and that it continues southwestward to the northwest corner of Louisiana, where it is represented by the Rodessa fault. The Rodessa fault has its downthrow on its south side which harmonizes with this basement fault—and it is responsible for a very important gas field having its production from the oolitic bed beneath the anhydrite series of the Glen Rose. The gas in this field is excessively rich in gasoline content and there seems a tendency at present for this field to change from gas to a high-gravity oil field.

The index map shows a large number of faults in the surface beds and at shallow drilling depths in the general oil district of Arkansas and southwestward. With major basement faults present, as just described, it would be a natural mechanical consequence for these lesser and younger faults to be present.

Thin Veneer of Tertiary Beds

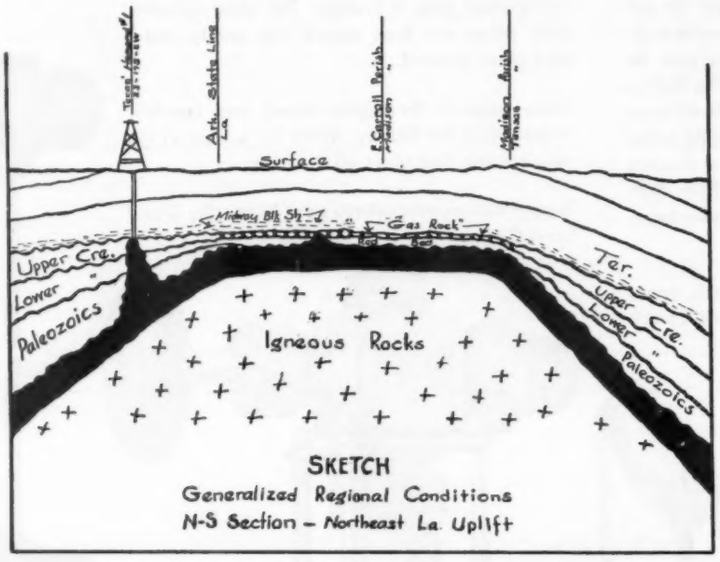
Now, having described this large regional uplift, spoken of as the Monroe-Richland uplift, I will go a little farther in order to show more clearly the operating conditions in seeking new pools of oil and gas thereon.

Except for remnants of Cretaceous, mentioned earlier herein, this igneous region is covered only by some members of the Tertiary. The Tertiary history of this region has been discussed in great detail, accompanied by appropriate maps and figures, by C. L. Moody.[11] He mentions the fact that the Monroe-Richland area suffered greater early deformation than did the Sabine uplift region. He points out that across the Mississippi River, in Sharkey County,[12] the Midway lies directly on igneous rocks of andesitic composition and says that the heterogenity of the floor over which the waters of the Midway sea spread points to a complex history during prior time. His diagrams show that, following the deposition of the Midway, the strand line became a veritable will-o'-the-wisp — first south, then north, and laterally as well. This, of course, means a great amount of movement continuing ever since the basement floor was covered. In other words, this portion of Louisiana suffered much mechanical movement long before even the Cretaceous was reached and such movements have continued all along to the present time as shown by the Alabama Landing fault. This in turn means numerous local folds and faults in connection with which oil and gas may be produced.

One important feature of the Tertiary history is the fact that the Jackson formation is mapped from near Little Rock southward to near Hamburg, Ashley County, Arkansas; and that this north outlier of Jackson lies in the west portion of the Arkansas syncline. (See the geological map of Arkansas.)

These will-o'-the-wisp movements subsequent to the deposition of the Midway, resulted in a thick body of Wilcox in this Arkansas syncline. There are other evidences that there is a deep syncline to the north of the Monroe-Richland uplift, with its deepest point near the Mississippi River in Desha County, Arkansas.

This Arkansas syncline, being present in the basement floor as well as in all of the beds upward to the present surface, shows a pronounced north dip from the regional high located in Northeast Louisiana.



SKETCH
Generalized Regional Conditions
N-S Section – Northeast La. Uplift

Source of Oil and Gas on Monroe-Richland Uplift

So far I have shown that the large area constituting Northeast Louisiana is a regional high in the basement beds, bounded on its west by the Monroe fault, on its east by the Yazoo fault, and on its north by the Arkansas syncline. It is bounded on its south by the Angeline-Caldwell flexure (monocline), which represents a rather abrupt increase of steepness in the general, or regional, south dip of the beds of North Louisiana. I will not go into details about this flexure since it is known and has been discussed almost as much as the Sabine uplift. But it sets out a pronounced south dip from this regional high. (See sketch of north-south section of Northeast Louisiana uplift.)

Oil and gas can migrate to this regional high equally from the north and the south. Such migration channel applies to all beds from the basement floor up to the surface. The east-west crest, or backbone of this Northeast Louisiana uplift, seems to lie across the southern part of East Carroll and West Carroll Parishes. Farther south, say in Madison Parish, and in portions of Franklin and Tensas Parishes, it is possible to find production in true shoreline traps.

Repeating, it is my conception that Northeast Louisiana was a very high region throughout all of its history before Cretaceous time, remained largely an island during Cretaceous time (and, therefore, received practically no Cretaceous deposits) and it has continued to rise to some extent since Midway time. All this fits in with the major movement—the upthrow of the Monroe fault and the Yazoo fault.

No Salt Domes in Northeast Louisiana

My theory as to the origin of salt domes, although not accepted at the time (about 1920) is the only one now considered. Obviously, salt domes are of mechanical origin exactly as though one were to hold a magazine or book horizontally and then with a mighty jab junch an icepick upward through the leaves. The nearly-vertical upturned beds surrounding the domes which have come to the surface; the blocks of certain layers brought upward just as a glacier transports large rocks; and many other known conditions show the origin to be wholly mechanical. A deeply-buried bed of salt, weighted down by many beds, could flow upward through any weak spot, such as the intersection of two faults. This would be like mud squirting up through a knothole in a plank on which one steps in crossing a puddle.

This accepted theory assumes the presence of a bed of salt, which in turn points to the presence of the Permian (Paleozoic) which contains such vast layers of rock salt.

Since it is probable no Paleozoics are present on the top of this Northeast Louisiana uplift, one would not expect to find any salt domes. The old salt works shown on the index map in south central Madison Parish used brine which undoubtedly is coming up through a local fault.

Spooner,[29] after mentioning the relatively shallow floor (3,000 to 3,500 feet to the basement, igneous in the three southeast counties of Arkansas) and pointing out its regional dip, shows this floor to be igneous in places south and Paleozoics farther north.

Since the Paleozoics are present farther north in Arkansas as the basement, there may be beds of Permian containing layers of salt, and it is entirely possible to find salt domes in the area of the Arkansas syncline—say, from Smackover northeastward—although none are now known.

In the Smackover Field a deep test found rock salt. This is the Lion Oil Co.'s No. 9-A Hayes, Section 4-16-15, Union County, Arkansas, which drilled solid salt from 5,900 to 7,255 feet—

(Continued on Page 43)

• EVERY Refinery Man Should be an Engine Salesman •

THE surest and most permanent way to improve the refinery situation is to increase the consumption of refinery products. One of the easiest, quickest and most profitable ways to do this is to use more gas and Diesel engines in the refineries and in every other branch of the petroleum industry. If all the power now used in the petroleum industry were produced with oil and gas engines there would be no need to restrict oil production. Isn't it logical that you should start at home to boost the use of your own products — and reduce your power costs at the same time?

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Natural Asphalts in Use Long Before They Were Refined From Crude Oil

By E. G. WOODRUFF
Consulting Geologist, Tulsa

Natural asphalts are the black or dark brown bitumens found in seeps in veins or permeating limestone or dolomite as a part of them. Natural asphalts range from hard high grade material suitable for varnishes, insulation and other special uses to the low grade suitable only to cement sand and crushed rock in pavement or for other common uses where a waterproof material is needed. The Gilsonite of Utah is a black brittle bitumen with no trace of impurities in it. On the other hand the asphalt from Trinidad Pitch Lake is a brown slightly viscous mass containing sand, clay, and shells up to 30 per cent of the mass. In some regions only one grade of asphalt is found whereas in others there is a variety of grades. In Venezuela only the soft semi-liquid kind occurs; in Oklahoma there are varieties from the best to the lowest.

It is the general opinion that asphalt is the residue from an asphalt base crude oil and that the lighter parts of the crude have escaped by natural distillation or filtering. Probably most of the asphalt is derived in this way but there is considerable evidence that the asphalt was formed in the strata just as asphalt and that there never were lighter oils with it. Many of the limestones with asphalt in them indicate that the asphalt was formed when the limestone was deposited. It indicates that the asphalt is a part of the limestone and that it has not filtered in subsequent to deposition. If this view is true it means that an asphalt seep does not necessarily mean that there is an oil field in the vicinity. However, asphalt deposits along with oil seeps and gas seeps are good indicators for oil pools. These seeps are the surface indicators which have led to the discovery of most of the oil pools of the world. The beginning of our industry is founded on seeps in four places; two of these were asphalt, one oil and one gas. Because there were seeps in western Pennsylvania, Colonel Drake drilled there to start the production of oil there in 1859; the next year Brown and others drilled near Paoli, Kansas, in the vicinity of asphalt seeps to lead to the opening of the Mid-Continent pools; in California, the California Star Oil Co. in 1876, drilled near the brea (asphalt) and laid the basis for the production of 1,000,000 bbls. of oil in that state; on the Texas-Louisiana Coast it was the gas seeps at Spindle Top and other domes which induced Lucas to drill at Spindle Top. The same story holds true of Mexico, Venezuela, Rumania and elsewhere. In fact oil seeps, mostly asphalt, have shown where more oil pools are than any other indicator. Starting from seeps more oil has been found than in any other way or all other ways combined. On the other hand there have been many failures in drilling near oil seeps on the assumption that there is an oil pool deeper or down the dip. Such assumptions may be true but in many places it is not. At some seeps practically all of the oil has escaped to the surface and very little is left underground; in others there never was much oil or asphalt; while in others the asphalt is in a limestone or other soluble rock and was freed by the solution of these rocks and escaped to smear up the surface but it did not come from a real pool. Hence an asphalt seep does not necessarily mean there is an oil pool near but it is a good place to look.

Fool Asphalts

Like "Fool's gold" which is a combination of iron and sulphur we also have fool asphalts. One company spent more than $200,000 drilling in West Texas on the belief that a brown stain in the limestone was asphalt and that a pool was down the dip. The brown stain analyzed to carbonate of iron. It has no relation to oil. Frequently along the outcrops of lignite beds there is a black waxy substance which looks like asphalt and is sometimes mistaken for it. The chemists have found this to be an amorphous carbon derived from the coal. The simple test for this substance is to dip the hands in the mass then wash them in water. This fool asphalt will wash off while the real substance will not. Yet in spite of this simple test samples have been collected and sent for analysis. Well promotions have been based on this substance.

It is to be remarked also that while asphaltic oils leave an abundance of oil where they escape the paraffin oils seldom leave any residue where they have escaped. There must have been such seeps. If our ideas of the underground movement of oil are at all correct many millions of barrels of oil have escaped along the outcrop of the formations and only a small part of the total has been trapped in the pools. When a map of an oil region is made to show the pools on the exact scale it appears that the oil pools occupy only a small part of the area and that there is much more chance for the oil to escape between the pools than there is for it to be reservoired in them. Yet in the light oil regions there is no evidence of the escape of oil along the outcrop of the oil sands. Hence asphalt seeps indicate the presence of oil only where there is heavy oil. As an example there is no seep along the Bartlesville sand outcrop in Oklahoma or along the Jackson outcrop in Texas but the heavier oils of the Healdton area and in Mexico have left an abundant residue.

Maps of North and South America showing location of asphalt deposits

Mode of Occurrence

Asphalt beds do not have any typical mode of occurrence. Most of them are on flat surfaces but it is not infrequent to see the asphalt ooze from the canyon walls or on steep slopes. They may be in the beds of the creeks or on desert plains. While most asphalt beds now known are on the land there are some under the ocean; a bed has been worked off the north shore of Cuba. The association of marine shells in the Trinidad asphalt, in the Southwest Texas beds and in some asphalt near Sulphur, Okla., leads to the conclusion that these deposits were asphalt seeps under the ocean when they were formed. The largest seep of asphalt in the world at Guonoco in eastern Venezuela is just above tide level in a swamp area at the foot of rugged hills; the Maracaibo seeps are on the lake shore. With a little depression these beds would be under marine water.

In Mexico there are patches of asphalt like old worn pavement in the jungle brush. There are vertical veins of the Gilsonite variety of asphalt at the surface and extending downward in the arid plains of Northeast Utah. There are the tar sands along the Athabaska River in northern Canada. Thus it will be seen that the natural asphalt is not confined to any particular elevation; it is found in the warm tropics, in the moderate zones and in the cold of the North. There is one distinction worthy of note, namely that, except in a few places, asphalt is found north of the equator. This does not mean that the substance can occur in the southern hemisphere but apparently it does not. In considering this in relation to the crude oil supplies of the world the thought is suggested that possibly the supplies of crude oil are also confined to the northern hemisphere. At this time Australia, Africa, and the southern part of South America do not give promise of extensive oil pools.

Natural vs. Refinery Asphalt

Native asphalt and refinery asphalt are keen competitors in the markets where these materials are used but it has not always been this way. Many centuries ago, as much as 500 B.C., native asphalt was used by the Greeks as cement for bricks and stones in the construction of their buildings. The Inca Indians of Peru used the material long before the Spaniards came to conquer them. In more modern times asphalt pavement was laid in Paris in 1835 and three years later in Philadelphia. In 1876 Pennsylvania Avenue in Washington, D. C., was paved with asphalt. The last 50 years has shown an extended use of the material both in quantity and variety of uses. In 1939 there were 702,777 tons sold at the mines in the United States.

The first use of refinery asphalt is not known but the extensive use is limited to the last 25 years. According to the reports of the Mineral Resources of the United States 159,424 short tons of asphalt made in refining oil were marketed; in 1921 there were 624,220 tons; in 1930, 2,273,546 tons. Thus, in the United States about 30 per cent of the asphalt used is mined and about 70 per cent comes from the refineries.

The desirability of the refinery asphalt is not difficult to understand; the natural asphalts have passed through nature's processes and reached certain points where they have definite properties, these properties are not uniform in different deposits and not uniform in the same deposits. When used it is difficult to obtain dependable results. The manufacture of refinery asphalts is carefully controlled to yield a product with properties especially fitted for the purpose intended. The contest in the markets is between the accurately controlled properties of refinery asphalt against cheapness of native asphalts.

World Sources

Below is presented a list of the occurrences of asphalt by countries. The data

(Continued on Page 49)

Gum is a dose the automobile engine can't swallow Gum sticks in its throat

It stutters, it gags, it chokes—sometimes it dies

When this happens in your customer's engine do you think he will ever come back to your station?

It won't happen if the chemical cop is on duty in the refinery that makes your gasoline

The chemical cop is Universal liquid inhibitor—keeps the gum all out and the anti-knock value all in

A pigmy in cost—

a giant in value

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Progress on the Pact

With the interstate compact already approved by the legislatures of Kansas, Oklahoma and New Mexico the Texas House of Representatives has followed with an overwhelming vote to ratify the bill, 110 to 1. It also passed the new conservation bill codifying the oil regulation laws and extending the market demand law two years by a similar majority.

This bill, according to Representative Latham, its author, "places the oil and gas laws of Texas in such position that the oil industry and lawyers can tell what the law is," surely a sufficient commentary on the existing situation.

As soon as Texas completes ratification of the compact it is understood Congress will be asked to enact permissive legislation. Meanwhile, it is being suggested from Washington, steps should be taken to set up a co-ordinating agency. Provision should be made for the United States Bureau of Mines to continue compiling the crude demand estimates and suggest allocations, while expiration of the code has renewed consideration of legislation regarding imports and withdrawals from stocks.

Meanwhile opposition to the Federal control bill is being registered at Washington and it is admitted there is little chance of it being passed at this session. It can be effectively disposed of by prompt action by the industry and the oil states.

Refining Survey

An increase in the number of plants rather than an increase in size is recorded in the Annual Refinery Survey published in this issue of The Oil and Gas Journal. The expansion in smaller units is, of course, chiefly due to conditions in East Texas and is probably a temporary phase.

One of the significant features is the increasing use of chemicals in refining and in the utilization of refinery cracked gases as a basis in the manufacture of a number of chemical products. This drawing closer of the petroleum refining and chemical industries marks the trend towards fuller realization of the possibilities for wider utilization of petroleum in a variety of products. In this particular instance material that was previously burned is converted to higher uses, its place being taken by base oils or solid fuel such as coke.

Certain chemicals used in manufacturing when blended or compounded with lubricating oils or motor fuel promise to permit automotive engineers to design engines that will develop still greater power through utilizing more of the energy in the oil.

While market quotations were out of line during the year the great advance in technical processes and the return to peak consumption, taken with the present strengthening of the market, encourages the refining branch to look forward to a prosperous year.

Too Complex for Haste

The report of the special committee appointed by Administrator Ickes some weeks ago to make a survey of the workings of the oil code is concerned chiefly with the small non-integrated refiner and marketer.

The conclusion that there should be either an increase in the prices of refined products to a parity with crude prices or a reduction in crude prices to a parity with the prices of refined products is familiar but it is refreshing to read that "the first alternative is preferable because it would relieve the refiners without injuring the producers." The committee's sympathy for stripper well operators is also fair minded.

But when the report turns from the discussion of facts to suggesting theoretical recommendations it is not so clear. Assuming that integrated companies may "sell below cost by using the profits from operations in one branch of the industry to subsidize losses in another" three of the five members of the committee urge that the operations of the industry be segregated into the four separate branches, production, pipe line transportation, refining and marketing.

Yet they say "We do not recommend requiring divorcement of management and operation of the separate corporations; such divorcement, we believe, would be unnecessarily disruptive, especially expensive to small and medium size companies and inadvisable from the standpoint of efficiency of operations."

Their idea is that "corporate separation alone, without interfering with the control and coordination of over-all operations would assure 'arm's length' transactions between the different corporations."

It is obvious that Mr. Swensrud was right when he "felt that the questions involved were too complex to warrant the committee making any final recommendations on the basis of the limited study it was possible to give to the matter."

Need for Reserves

Tulsa will be glad to welcome the American Association of Petroleum Geologists which concluded its annual convention at Wichita, Kansas, last week by receiving the invitation to meet in this city next spring.

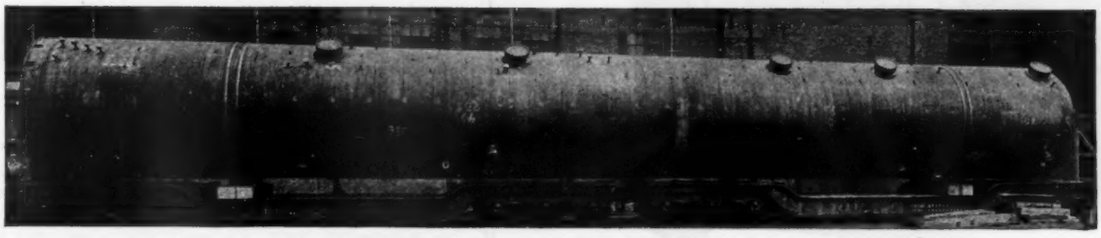
The oil industry was particularly interested in the address of the retiring president, William B. Heroy, in which he said:

"It should be made very clear that the oil supply of fields discovered more than ten years ago has been largely exhausted and that the present requirements for crude oil are being supplied chiefly from more recently discovered fields. With the continued testing of the remaining wildcat territory and the increased difficulty of finding new pools the question of how much oil remains in the ground becomes more and more acute."

With all the advances made in scientific search for oil the experience of the past few years has shown there is no guarantee of new reserves. Wallace Pratt's deduction that at least 20,000 wells must be drilled each year to maintain our supply is being proved by facts. We need to uncover the equivalent of a billion barrels of oil a year—50,000 acres capable of producing 20,000 barrels per acre—to replace our annual consumption. And we have not been doing it.

The big fields which so long overhung the industry are either passing their zenith or producing their limit.

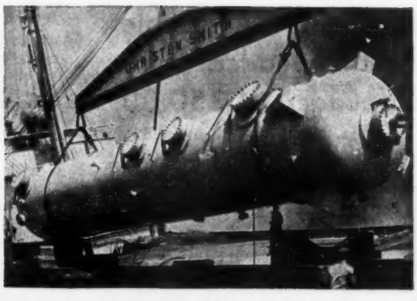
Stabilizer tower—8′ 6″ I.D. x 2.02″ thick x 71′0″—weight 182,750 lbs. Masterwelded plate construction.



Masterwelded viscosity breaker evaporator—12′ 0″ I.D. x 1-3/16″ thick x 95′ 0″.

Upper section—2 pass S.R. gasoline condenser containing 992—1″ 11 admiralty tubes 14′ 2″ long.

KELLOGG MASTERWELD DUCTILE TOUGH



Evaporator tower—8′ 0″ I.D. x 2″ thick x 55′ 4-3/8″ long. Seamless construction.

Clay treating tower being x-rayed in Kellogg shop.

Inserting tube bundle in heat exchanger shell.

Kellogg heat exchanger sections assembled for shipment.

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Proof of Profit Not Prophecy

Close-up of HS-6-SRKL Double Drum Unit with Spudder. Price of Unit and Spudder $4,350.00

Santa Rita Oil and Gas Company
Cut Bank, Montana
March 8, 1935.

The All Steel Products Mfg. Co.,
P. O. Drawer 2001,
Wichita, Kansas.

Attention: Mr. H. W. Cardwell, President.

Gentlemen:

In reply to your letter of February 11th, we are giving you below figures covering operation of our HS-6-SRKL double drum unit in comparison with former method used in finishing wells in the Cut Bank field:

Deepening, Cleaning out and Swabbing	HS-6-SRKL Unit	Cable Tools
121 days (24 Hrs.)	$9,826.00	$16,125.00

The above figure on the Cardwell unit includes labor, repairs, fuel and oil, depreciation and depletion. We received this unit in April, 1934, and from May 1, 1934, to February 28, 1935, our total repairs amounted to only $52.00, and the unit is in first class mechanical condition at this time. In addition to the 121 days the unit was used in deepening, cleaning out and swabbing wells, the unit was also used in pulling rods and tubing. The average cost per eight hour day covering repairs, fuel (natural gas), oils and greases is $6.00.

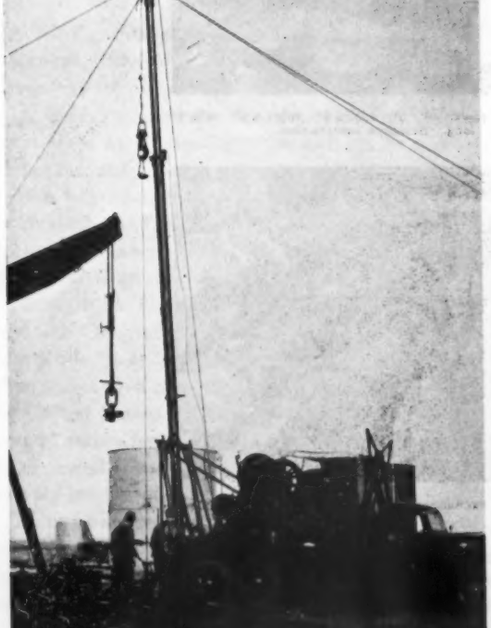
This unit has proved to be entirely satisfactory in every use that it has been put to, and as you know, the depth of the wells in the Cut Bank field is approximately 3,000 feet.

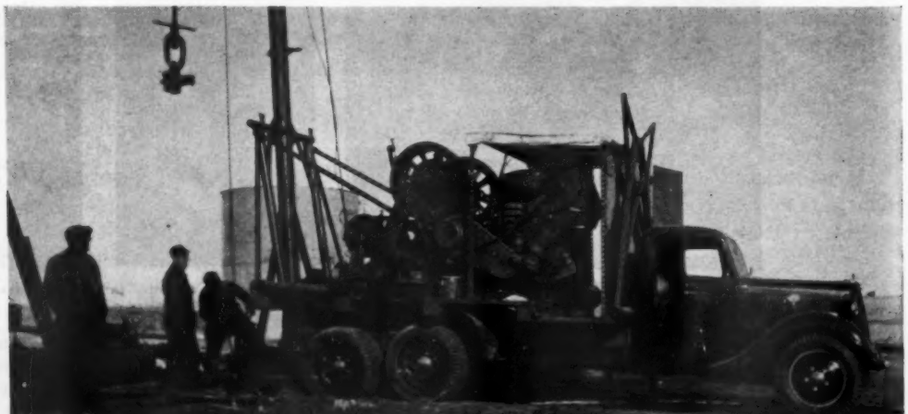
In line with your suggestion, we assure you that at any time we have a criticism to offer we shall not hesitate to present it.

Yours very truly,
SANTA RITA OIL AND GAS COMPANY
M Sadler
Secretary.

ENS-ed

This letter needs no further explanation





These are photographs of Santa Rita Oil and Gas Company Units

CARDWELL
TRADE MARK
REG. U. S. PAT. OFF.

ALLSTEEL PRODUCTS MFG. CO.

Phone: Long Dist. 289 Wichita, Kansas, U. S. A. 801 So. Wichita

NEWS FROM FOREIGN LANDS

MEXICO

At an informal meeting in London the shareholders of the Mexican Eagle Oil Co., Ltd. (Compania Mexicana de Petroleo "El Aguila" S. A.) appointed a committee of three shareholders to cooperate with Batasfache Petroleum Maatschappij, managers of the company, in the solution of a serious problem which has developed as the result of court decisions and rulings in Mexico. The committee consists of Maurice Hely Hutchison, representing the Association of Investment Trusts, Arthur Floyd of the London Stock Exchange and William Kirkpatrick, member of Parliament. Trading in the stocks on the London Exchange has been suspended temporarily.

The decision to appoint a committee followed an explanation by Geoffrey Perry, London solicitor to the Bataafsche Petroleum Maatschappij after which a formal statement was issued reviewing the developments in the Mexican litigation which has now reached the stage where the Minister of Hacienda in Mexico has demanded the deposit in gold at the Banco de Mexico, in Mexico City of approximately 2,000,000 pounds sterling ($10,000,000) pending final decision by the supreme court in Mexico in a case in which a lower court has given a judgment of 20,000,000 pesos (approximately $5,000,000) to the Commercial Petroleum Co. against the Mexican Eagle Co.

The case which in one form or another has been in the Mexican courts for several years has attracted wide attention in the oil industry due to the unusual issues involved and ramifications of Mexican judicial procedure revealed in the action by different courts and arbitration boards. The Mexican Eagle, the principal representative of the Royal Dutch-Shell organization in Mexico is the largest single producer of crude oil in Mexico operating three refineries with large distributing facilities for the domestic consumers of petroleum products. The company also is a large exporter. Along with other foreign owned companies there has been considerable friction with government representatives over the past year, the recent troubles centering in labor disputes. The government has supported labor and the latter have won most of their requests.

This particular case dates back to 1912 when the Mexican Eagle acquired the oil rights to a plot of land in the Amatlan district. Amatlan Lot No. 113 proved productive several years later but it was not until 1925 that formal claims were made against the company. The claims were made by the illegitimate son of an alleged daughter of a man who had owned the property but who had disposed of it in 1901 to parties from whom the Mexican Eagle secured the lease.

Since 1925 there has been constant litigation with the decisions and findings favorable to the Mexican Eagle until last year. In September of last year the Commercial Petroleum Co. which had acquired the rights of the original claimant obtained the 20,000,000 pesos judgment in Tribunal Superior. The Mexican Eagle immediately appealed to the Supreme Court of Mexico and pending appeal gave counter bond to the Banco of Mexico, secured by sterling deposited to the amount of 2,000,000 pound sterling in the Midland Bank in London to the credit of the Banco de Mexico.

The plaintiff company objected to this bond arrangement and the Supreme Court finally ruled that the bond must be constituted within the Federal District of Mexico. This is the basis for the present critical situation in which the company is threatened with immediate seizure of property if the large gold deposit is not made immediately. Geoffrey Perry in explaining the present situation to the stockholders said:

"Since February 22 your managers and your company's representatives in Mexico have discussed with the Mexican authorities almost every conceivable method of providing a satisfactory counter bond for the Banco de Mexico which would avoid the risks inherent in the actual shipment of this enormous amount of gold to Mexico City. Alternatives put forward by your managers included, first, the possibility of another substantial bank in Mexico providing the counter bond for the Banco de Mexico against a sterling deposit to their credit in London or New York; second, the possibility that other interests with substantial assets in Mexico far exceeding the amount at stake, should give counter bond against a deposit to their credit outside Mexico by your company; third, the deposit of gold to the credit of the Banco de Mexico in the Federal Reserve Bank in New York or the Bank of England in London; fourth, the transfer of silver to the Banco de Mexico in Mexico City;; fifth, the deposit of gold to the credit of the Banco de Mexico in the Bank of International Settlements at Basle.

"None of these alternatives has proved acceptable to the Minister, who refuses anything but the deposit of gold in the Banco de Mexico in Mexico City.

"The presentation and discussion of these different alternatives by your representatives in Mexico with the Mexican authorities has entailed continuous telephone and cable communication with your managers, who feel that every alternative to the shipment of gold has been explored as thoroughly as possible in the short time available.

"Although the exact time within which the counter bond must be furnished in a form satisfactory to the Mexican authorities has not been definitely stipulated by the court, your managers are informed that probably only a little more time is left and a final decision should be taken immediately. Your managers wish me specially to emphasize that having taken the best legal advice possible in Mexico, they are absolutely satisfied as to the justice of your company's case. Your managers feel that they cannot take the grave decision whether to ship or not to ship this enormous quantity of gold to Mexico without bringing the facts to the notice of the shareholders.

"In the short time at their disposal it has been impossible to summon a meeting of the shareholders in accordance with the company's constitution. They feel therefore that the only thing they can do is to summon this informal meeting in order to give you this report so that you could appoint an advisory committee of three shareholders to cooperate with them in dealing with the present emergency."

JAPAN

Announcement from Tokio that Japan is desirous of purchasing the northern part of the island of Sakhalin from Russia in order to secure valuable oil properties is in line with developments which have been anticipated by American oil interests for several years. The island which is off the coast of Siberia is remote from other oil operations of the U.S.S.R., while the southern end of the island is only a short distance from Japan. The latter country is anxious to secure oil reserves to take care of its domestic requirements for petroleum products the bulk of which are now obtained from the Netherlands and the United States.

The oil administration of the U.S.S.R. has never aggressively carried on a development program on the island due, it is said, to the dominant position of Japan in the Far East which would enable that country to take over the fields and supplies in event of war.

Japan acquired the southern half of the island in 1905 at the close of the Russian-Japanese War. All the known reserves are located in the northern half. A company controlled by the Japanese government has been carrying on development work under an 11-year agreement with the Russians which expires next year. It is now believed that the government is anxious to obtain the remainder of the island before the agreement expires.

The present production of the Russian owned half of the island is approximately 5,500 bbls. daily. The bulk of the oil is purchased by Japan. The principal producing field is Okla which lies between Baikal and Unkt Bays. The field is connected by a 15-mile pipe line to a loading terminal at Moskaboo located on the northwestern part of Baikal. This terminal is accessible only during the summer season. It is said the Japanese have done considerable geological work on the island and other potential producing areas have been outlined. The island is about 600 miles long and from 50 to 100 miles wide.

Pipe line in Peru of the International Petroleum Co. Ltd. Lines are supported above ground to prevent corrosive action of soil.

PRODUCTION

Production in Venezuela for the four weeks ending March 16 (data in barrels):

Caribbean Petroleum Co.:	
Mene Grande	1,188,700
Venezuelan Oil Concessions, Ltd.:	
La Rosa	617,000
Lagunillas	1,928,400
Conception	112,700
La Paz	15,300
Colon Oil Corp.	391,000

Production in Peru for February and first two months of 1935 and 1934 (data in barrels):

	1935	1934
February	1,105,508	1,041,658
January and February	2,353,973	2,230,198

Production in Colombia for February and first two months of 1935 and 1934 (data in barrels):

	1935	1934
February	1,141,696	903,471
January and February	2,795,343	1,916,221

Production in Persia for February and first two months of 1935 and 1934 (data in tons):

	1935	1934
February	587,095	569,786
January and February	1,217,197	1,162,750

Revised report shows that total crude oil and natural gasoline production in Persia for 1934 was 7,537,372 tons.

U. S. S. R.

The government of the U.S.S.R. has issued final figures covering crude oil production and refinery operations in that country for 1934. The final data show only minor differences when compared with the preliminary report. The report shows there was a general expansion in crude oil production, drilling and refinery operations in 1934 over 1933.

The following table summarizes the information given by government (data in tons):

Crude Oil Production Operating trust—	1935	1934
Aznoft	19,192,800	15,326,000
Groznoft	3,371,500	4,862,300
Mainoft	938,200	590,800
Embanoft	239,100	196,400
Others	418,900	457,500
Total	24,150,500	21,433,500
Refinery Operations		
Crude oil to stills	20,736,200	18,517,500
Gasoline output	2,785,400	2,701,500
Kerosene output	4,485,700	3,877,900
Drilling (meters)		
Aznoft	792,090	528,525
Groznoft	243,968	137,471
Mainoft	58,012	40,471
Embanoft	46,574	36,332
Others	1,256,222	835,535

GREAT BRITAIN

Imports of gasoline into the United Kingdom increased in January over January, 1934, but crude oil imports decreased with losses in some of the refinery products so that total imports were less. The imports based on government reports for January, 1935 and 1934, were as follows (data in Imperial gallons):

	1935	1934
Crude oil	26,725,000	34,854,000
Gasoline	93,231,000	84,942,000
Naphtha	1,962,000	1,676,000
Kerosene	24,420,000	26,136,000
Lubricating oil	4,117,000	9,473,000
Gas oil	17,029,000	8,715,000
Fuel oil	44,002,000	54,834,000
Other oils	74,000	13,000
Total	211,560,000	220,643,000

Gasoline Holds Its Ground in Group 3 Territory With Indications of Continued Improvement

By T. F. SMILEY

Gasoline prices, watched with confidence by some, with doubt by others, were holding their ground this week in the Oklahoma (Group 3) territory. In the meantime reports of better motoring conditions in northern consuming areas brightened the general picture.

Whatever may be the ultimate outcome of agencies now in operation designed to stabilize the gasoline market at profitable levels, evidence grows that they are exercising a beneficial influence at the present time anyway and that the trade may reasonably look forward to an increasingly strong market as the season of heavier consumption advances.

Market Views Differ

Belief that a rather steadily firming trend lies ahead is not unanimous, but it probably is held by a majority of the refiners in the Oklahoma territory. Most of the skeptics seem to be among brokers and jobbers, some of whom call this a "quotation" market. They point out that although prices show no disposition to sag, the spot market is stagnant. They say this indicates material is being held back for higher prices which it is hoped to get. It would be easy, they assert, to dam up more gasoline than the market could absorb if it were released at one time.

Some of those too who eye the present situation with distrust have been disappointed so often by market remedies tried out in the past that little short of clear and positive performance can jar their incredulity now. Pleasant prospects do not stir their interest.

There are said to be no gasoline stocks of threatening consequence in the Group 3 area. This is attributable for the most part to the understanding reached by Mid-Continent integrated companies on one hand and the smaller independent refiners on the other in accordance with which the former are buying any excess stocks accumulated by the latter. So well cleaned up have stocks looking for buyers been kept, as a matter of fact, that instances are reported in which independent refiners, instead of asking for help as they were privileged to do under the support-buying arrangement, have found themselves forced to do some buying themselves in order to fill their contracts.

Holding for Higher Prices

Although there is reason to believe a few refiners are hanging onto material in the hope of getting an eighth or so more than the present market yields, it is not believed this device will be resorted to in such a degree as to invite serious price disturbance. And it hardly is to be assumed that refiners will deliberately ruin their own market.

Appearance of East Texas gasoline in northern markets lately is said to be open to several explanations. One is that it reflects scarcity of supply in Oklahoma rather than surplus stocks in East Texas. It is declared that if it were not for trucks which continue to move the output of East Texas refineries operating on illicit crude there would be a scramble for every gallon of legal gasoline made in that district.

Another explanation lies in the fact that when the present uptrend in motor fuel was getting under way a few weeks ago and low-octane U. S. motor was quoted at 3⅝ cents for reselling, East Texas refiners, confident of better prices, refused to consider offers at the figures then ruling, naming 3¾ cents as the lowest they would accept for shipment over the succeeding month. Somewhat to their own surprise perhaps, some of the inquirers agreed to pay that price. Part of the material moving northward recently is said to have been contracted for at that time.

There is no apparent division of opinion on the point that, except for trucking of illegal gasoline, East Texas is well under control and there is promise the truck evil will be abated.

A common view of the outlook is that with ready absorption of all motor fuel offered in Oklahoma, East Texas and North Texas and with weather conditions daily becoming more favorable for increased gallonage, it will take a bigger obstruction than is in sight anywhere now to cause more than temporary interruptions of the present rising market.

Naturals a Little Better

Demand for natural gasoline was slightly better. It came largely from Texas refiners inside the refining territory rather than for movement to the Gulf for coastwise or export shipment. The firm refinery gasoline market was reflected in the natural market. Fair demand for the stabilized grades continued.

Kerosene softened a little, but recovered and prices remained unchanged.

Furnace oils were slipping, with spring weather appearing in widened areas. Prime white and white straw, which had been somewhat scarce, appeared in volume more than sufficient to meet demand, and quotations for these grades were off along with the rest of the list. Chicago marketers who had ordered furnace oils during recent cold spells were asking the refiners to rush delivery this week, evi-

(Continued on Page 48)

Refined Oil Market Barometer

The gasoline market is assuming a more cheerful aspect in virtually all areas, with road and weather conditions improving and with a greater measure of stabilization than has been known in a long time. Feeling is general that there will be only minor interruptions of the present rising trend until the peak of summer consumption is reached. Higher retail prices in various districts would impart needed stimulus. Demand for tractor fuel growing. Furnace oils near the end of their season.

Mid-Continent.—Gasoline firm. Naturals steady. Kerosene irregular. Cracking stock up. Furnace oils off.

East Coast.—Gasoline moderately better. Kerosene off. Lubricants weak.

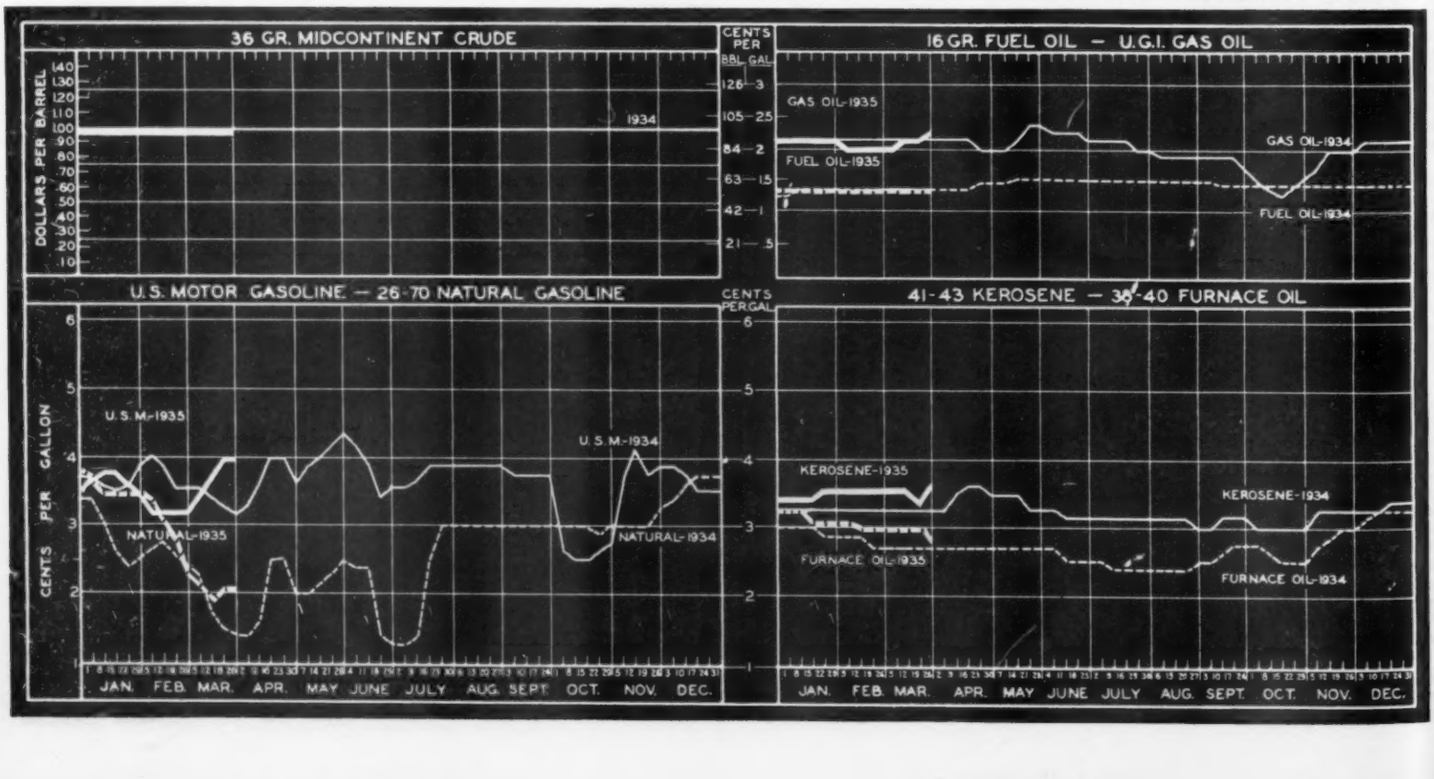
Gulf Coast.—Gasoline slightly firmer. No change in other products.

Pennsylvania.—Gasoline and kerosene higher and firm. Fuel oil movement good. Upward revision of bright stocks expected.

California.—General market easy. Fuel oil soft. Diesel stronger. Lubricants softer.

Chicago.—Gasoline continues strong. Kerosene spotty. Good inquiry for tractor fuel.

Representative Mid-Continent Quotations on Crude Oil and Refined Products Basis Oklahoma (Group 3)



Price Changes in Eastern Refined Market Were Again on the Down Side During Past Week

By C. O. WILLSON
New York Bureau, The Oil and Gas Journal

NEW YORK, Mar. 25.—Price changes in refinery markets of this territory were again on the down side over the past week. Kerosene tank car prices were reduced one-fourth cent per gallon bringing the general quotation to 5¼ cents with barge deliveries one-fourth cent lower. Those companies which have been quoting the same price for No. 1 furnace oil as kerosene, made the reduction also effective for that product. These reductions applying to most points along the Atlantic Seaboard are due in part to a price collapse in kerosene at the Gulf Coast. The market there appears to have become temporarily glutted with kerosene which has been offered to coastwise and export buyers at quotations which have been lowered almost from day to day. The 41-43 water white grade has been offered at the Gulf as low as 4 cents with some buyers of the opinion that this price could be shaded with orders.

Paraffin base lubricants were also weak in this market. Quotations on steam refined stocks and bright stocks for domestic movement are one-half cent lower on most grades. The Pennsylvania neutrals continue to decline with the 200-3 grade offered in export channels at 30 cents in barrels and around 24 cents in bulk to the domestic trade. The western stocks and neutrals are also weak with generally lower quotations. The active grades of Gulf Coast neutrals are fairly steady in local sales. Quotations reported on crude scale wax indicate a wide difference of opinion as to the going market. The 124-126 material has been sold under 2 cents according to reports with prices of large suppliers ranging up to 2.25 cents. These suppliers state that they are getting new business at this top figure.

Gasoline Situation

If there has been any change in the gasoline situation over the past week, it has been for the better. Prices are unchanged and the retail and posted dealer market situation at most of the larger consuming centers in New York State and New England, continues unsatisfactory. Where these low dealer and consumer prices are protected by guaranteed margins, the net tank car prices at refineries and water terminals in many cases, range from 3 to 4 cents per gallon.

The situation in the spot gasoline market appears to be better than it was a week or two weeks ago. There are fewer complaints of price cutting and predictions are again heard that the entire gasoline market will be on a higher price level by the end of the month. The basis for the optimistic predictions is the improved price situation at the Gulf Coast. The reduction in hot oil operations in East Texas and the refinery buying of surplus gasoline from small operators has brought improvement in the supply situation at the Gulf and better prices have resulted. It is said that this buying program will continue and expand over the next few weeks provided hot oil operations are reduced to a minimum.

Should the improvement at the Gulf continue, it is assumed that gasoline spot tank car prices in this territory will return to the levels which were effective early in the year including tank car, posted dealer and service station quotations. In other words the sellers would regain the ground lost over the past six weeks and the general market would be in the position hoped for following the low levels the latter part of last year. Warmer weather which is stimulating retail consumption in this territory has also served to emphasize the desirability of having gasoline prices return to profitable levels.

Gulf Crude Market

A development to which some observers attach considerable significance, is the stronger crude oil market at the Gulf. This market has been gradually stiffening in recent weeks until the present price is around $1.19 per barrel for tanker shipments. Practically all of past year this Gulf market on Texas crudes was lower than warranted by the posted schedules at the well. East Texas crude sold at the Gulf as low as $1.10 per barrel. Based on a $1 per barrel price at the wells in East Texas and allowing minimum costs for transportation to the Gulf and handling charges there, the Gulf price there should be at least $1.20 per barrel. The fact that it did not reach that level last year was due to the low prices which prevailed for refinery products coupled with the fact that some cheap East Texas crude oil was in storage at coastal points.

Over the past few months the number of concerns which have crude oil to offer at the Gulf has decreased. At least two large companies which sold cargo crude in 1934 and 1933 at the Gulf have announced they will have nothing to offer this year unless crude oil allowables are increased and they are permitted to secure more crude at their pipe line terminals.

It was thought several months ago that the availability of the Iraq crude oil in Europe would decrease the purchases of crude in this country. So far that situation has not developed. There continues to be numerous inquiries for East Texas and other crudes at the Gulf and there have been representatives of European refiners in this country over the past month who are anxious to contract a year's supplies. The Iraq crude is not an easy crude to refine compared with most of the crudes in the United States, due to the high sulphur content. The sellers of Iraq crude so far have not quoted attractive prices at the Mediterranean terminals of the pipe line.

If this tighter crude market at the Gulf continues, it may have significance from several angles. It will tend to place export prices on gasoline at the Gulf at more satisfactory levels. The relatively low foreign prices last year were one of the factors which made it impossible to maintain domestic prices in this country for refinery products in line with the prices established for crude oil. The disposal of excess Rumanian gasoline largely dominated the Gulf market in this country and there was relatively little spot gasoline sold throughout 1934 even at the low prices quoted by American sellers. Increased export business at the Gulf would tend to improve the coastwise market situation and minimize the danger of excess material at the Gulf being dumped on this market during the year. Observers of this situation while encouraged by recent developments, state that it is too early in the year to make any definite predictions in regard to the European markets.

Fuels

The tank car price of 4¼ cents for Nos. 2, 3 and 4 furnace oils and 4¼ cents for Diesel fuel announced 10 days ago are unchanged. Sellers report a fair to strong demand for industrial and marine heavy fuels. The Gulf price is steady. In this connection one sales manager calls attention to the change in the stocks of fuel oil and gas oil now and a year ago as shown by the weekly reports of the American Petroleum Institute. Stocks of fuel and gas oil at refineries on corresponding dates were as follows (data in barrels):

	Mar. 16, 1935	Mar. 17, 1934
East Coast	10,028,000	5,412,000
Appalachian	905,000	644,000
Ind., Ill., Ky.	4,326,000	3,123,000
Okla., Kans.	3,939,000	2,817,000
Inland Texas	1,869,000	1,525,000
Texas Gulf	8,377,000	6,002,000
La. Gulf	3,570,000	4,479,000
No. La.-Ark.	369,000	594,000
Rocky Mountain	732,000	694,000
California	64,910,000	86,442,000

According to this table stocks of fuel oil and gas oil at all refining centers east of the West Coast with the exception of Louisiana, are substantially higher than they were a year ago. These increases were more than offset with a decrease of 22,000,000 bbls. in stocks of California refiners. It will be recalled that last year California refiners sold an additional 10,000,000 bbls. of fuel oil to East Coast buyers. These data indicate that the shipments came out of storage. Due to the improved statistical situation, West Coast refiners have recently advanced their residual prices. This development tends to strengthen the price position of Atlantic Seaboard fuels and may have more significance before the end of the year.

Prices

Prevailing prices for products not previously mentioned include $1.15 for Bunker C and $1.89 per barrel for Diesel oil to the marine trade. The gasoline market in New York Harbor for the white grades is 5¼ cents for low octane; 5½ cents for middle octane and 5¾ cents for 65 octane and above. The reported quotations on 64-66 375 endpoint at the Gulf for export range from 4⅝ to 5 cents. Pennsylvania bright stock (No. 8) in barrels is 21½ to 22½ cents and 200-3 neutral, 30 to 32 cents.

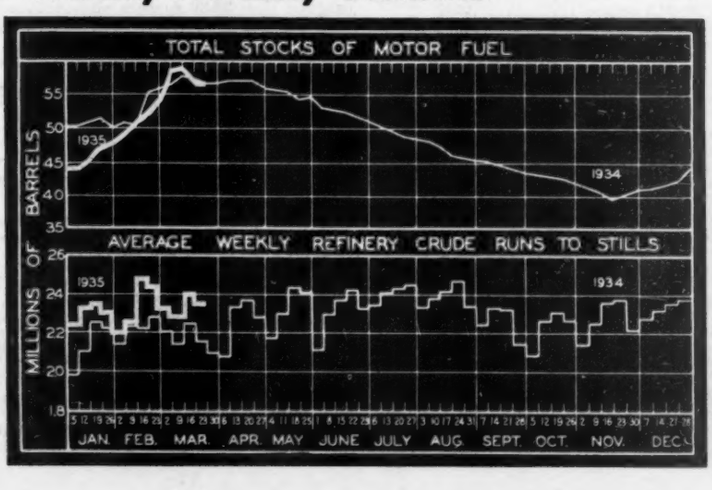
OIL TRUSTEE NAMED

Creditors of the Atlantic, Pacific & Gulf Oil Co. met recently in the office of Fred S. Hudson, referee in bankruptcy and named E. E. Amick of Kansas City permanent trustee for the company and its subsidiaries.

American Petroleum Institute Weekly Refinery Statistics

Week Ending March 23, 1935

	Capacity reporting per cent	Daily crude runs (bbls.)	Finished motor fuel (bbls.)	Gas oil and fuel oil (bbls.)
East Coast	100.0	422,000	17,710,000	9,894,000
Appalachian	93.3	105,000	2,134,000	810,000
Indiana, Illinois, Kentucky	94.6	335,000	9,722,000	4,322,000
Oklahoma, Kansas, Missouri	83.7	257,000	5,728,000	3,946,000
Inland Texas	47.6	103,000	1,447,000	1,883,000
Texas Gulf	97.7	527,000	6,720,000	8,461,000
Louisiana Gulf	96.4	110,000	1,466,000	3,547,000
North Louisiana and Arkansas	83.7	39,000	275,000	347,000
Rocky Mountain	66.7	43,000	965,000	750,000
California	96.9	443,000	10,704,000	65,391,000
Total United States	89.8	2,384,000	56,871,000	99,351,000



REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement except as otherwise noted

The following quotations are exclusive of the federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils.

Refinery Gasolines

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
U. S. Motor grades:				
Below 63 octane	.04	.04⅛	.04	.04⅛
63-70 octane	.04¾	.05	.04¾	.05
60-62 400 grade:				
Below 63 octane	.04	.04⅛	.04	.04⅛
63-70 octane	.04¾	.05	.04¾	.05
64-66 375	.04⅛	.04¼	.04⅛	.04¼
68-70 360	.04¼	.04⅜	.04¼	.04⅜
NORTH TEXAS—				
U. S. Motor grades:				
Below 63 octane	.04⅛	.04⅜	.04	.04⅛
63-70 octane	.04⅞	.05⅛	.04¾	.05
60-62 400	.04¼	.04⅜	.04	.04⅛
64-66 375	.04⅜	.04½	.04⅛	.04¼
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 63 octane	.04¾		.04½	
63-70 octane	.05½		.05⅝	
60-62 400	.04¾		.04½	
ARKANSAS (Ark., N. La. & Miss. del.)—				
U. S. Motor grades:				
Below 63 octane	.04¾		.04½	
63-70 octane	.05½		.05⅝	
CHICAGO (based on Oklahoma Group 3)—				
U. S. Motor grades:				
Below 63 octane	.04	.04⅛	.03⅞	.04
63-70 octane	.04¾	.05	.04¾	.05
60-62 400	.04⅛	.04¼	.03⅞	.04⅛
64-66 375	.04¼	.04⅜	.04	.04¼
68-70 360	.04⅜	.04½	.04¼	.04⅜
Aviation fighting grade	.05	.05⅛	.04⅞	.05
PENNSYLVANIA (inland refineries)—				
58-60 U. S. Motor:				
Below 60 octane	.05		.04⅞	
60-64.9	.05¾		.05¾	
65-70 octane	.06		.06	
68-70 350	.05⅝		.05⅝	
CALIFORNIA (domestic movement)—				
54-58 U. S. Motor	.07	.08	.07	.08
58-60 400	.08	.09	.08	.09
EAST COAST—				
U. S. Motor, below 60 octane:				
*New York	.05¼		.05¼	
Baltimore	.05½		.05½	
U. S. Motor, 60-64.9 octane:				
*New York (Bayonne)	.05½		.05½	
Philadelphia	.05¾	.06	.05¾	.06
Boston	.05½	.05¾	.05½	.05¾
Baltimore	.05½	.05¾	.05½	.05¾
Charleston, S. C.	.05½	.05¾	.05½	.05¾
U. S. Motor, 65 and above:				
*New York	.05¾		.05¾	
Philadelphia	.06	.06¼	.06	.06¼
Boston	.05¾	.06	.05¾	.06
Baltimore	.05¾	.06	.05¾	.06
Charleston, S. C.	.05¾	.06	.05¾	.06

*All grades of gasoline one-fourth cent less for small barge shipments.

GULF COAST (domestic)—				
U. S. Motor:				
Below 60 octane	.05	.05⅛	.05	.05⅛
60-64.9 octane	.05¼		.05¼	
65 octane and higher	.05¼	.05½	.05¼	.05½

Naphthas

	Mar. 26		Mar. 19	
PENNSYLVANIA (inland refineries)—				
50-52 (blending)	.04¼	.04½	.04¼	.04½
52-54 450 (blending)	.04¼	.04½	.04¼	.04½
54-56 450 (blending)	.04¼	.04½	.04¼	.04½
50-52 450 (blending)	.04¼	.04½	.04¼	.04½
CHICAGO (based on Oklahoma Group 3)—				
50-52 450 (blending)	.04	.04⅛	.03¾	.04
Cleaners' naphtha, 56-58 gr., 200 i.b.p., 320 e.p.	.06¾	.07	.06¾	.07
Lacquer diluent, 180 i.b.p., 250 e.p.	.07¾	.08	.07¾	.08
Lacquer diluent, 140 i.b.p., 200 e.p.	.08¾	.09	.08¾	.09
Rubber solvent, 68-70 gr., 100 i.b.p., 300 e.p.	.06¾	.07	.06¾	.07
Stoddard solvent, 300 i.b.p., 410 e.p., over 83° flash	.06¼	.06½	.06¼	.06½
Pet. thinner, 290-300 i.b.p., 410 e.p., over 83° flash	.06¼	.06½	.06¼	.06½
V.M.&P. naphtha, 56-58 gr., 190-200 i.b.p., 330 e.p.	.06¾	.07	.06¾	.07
Petroleum spirits	.05¾	.06	.05¾	.06

Natural Gasolines

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
Grade 26-70	.02⅛	.02¼	.02⅛	
Grade 18-55	.02¼	.02⅜	.02¼	.02⅜
Low vapor pressure grades:				
14 lb. v.p. (max.)	.03⅛	.03¼	.03⅛	.03¼
12 lb. v.p. (max.)	.03¾	.04	.03¾	.04
NORTH TEXAS—				
Grade 26-70	.02	.02⅛	.02	.02¼
Grade 18-55	.02⅝	.02¾	.02⅝	.02¾
Low vapor pressure grades:				
14 lb. v.p. (max.)	.03	.03¼	.03	.03¼
12 lb. v.p. (max.)	.03⅝	.03¾	.03⅝	.03¾
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
Grade 26-70	.02⅜		.02⅜	
CALIFORNIA—				
75-85 375	.05	.06	.05	.06

Kerosenes

(All kerosenes water white)

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
41-43	.03½	.03⅝	.03½	.03⅝
42-44	.03⅝	.03¾	.03⅝	.03¾
NORTH TEXAS—				
40-41	.03⅜	.03½	.03⅛	.03¼
41-43	.03⅝	.03¾	.03⅜	.03½
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
41-43	.03¾		.03¾	
ARKANSAS (Ark., N. La. & Miss. del.)—				
41-43	.03⅞		.03¾	
PENNSYLVANIA (inland refineries)—				
45	.04⅞	.05	.04¾	.04⅞
46	.05	.05⅛	.04⅞	.05
47	.05⅛	.05¼	.05	.05⅛
CHICAGO (based on Oklahoma Group 3)—				
41-43	.03⅜	.03⅝	.03½	.03⅝
42-44	.03⅝	.03¾	.03⅝	.03¾
CALIFORNIA (Pacific Coast consumption)—				
38-40 high burning test	.04½	.05	.04½	.05
NEW YORK (Bayonne, N. J.)—				
41-43	.05¼		.05½	
GULF DOMESTIC (domestic)—				
41-43	.04½	.04¾	.04½	.04¾

Petroleum Coke

(Prices per ton f.o.b. refineries in Chicago area)
(Refineries will absorb freight to 80 cents a ton)

	Mar. 26	Mar. 19
Pile run	6.00	6.00
Direct from still	7.00	7.00
Egg, nut, pea	8.50	8.50
Lump	8.50	8.50

Furnace Oils and Tractor Fuels

(Zero cold test under 190° flash and good odor)

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
32-36 straw	.02¾	.02⅞	.02⅞	.03
36-38 straw	.02⅞	.03	.03	.03⅛
38-40 straw	.02⅞	.03	.03	.03⅛
38-40 prime white	.03	.03⅛	.03⅛	.03¼
NORTH TEXAS—				
38-40 straw	.03	.03⅛	.03⅛	.03¼
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
36-40 furnace oil	.02¾	.02⅞	.02⅞	.03
ARKANSAS (Ark., N. La. & Miss. del.)—				
32-36 furnace oil	.02¾	.02⅞	.02⅞	.03
CHICAGO (based on Oklahoma Group 3)—				
32-36 straw	.02⅞	.03	.02⅞	.03
38-40 straw	.03	.03⅛	.02⅞	.03⅛
38-40 prime white	.03⅛	.03¼	.03⅛	.03¼
NEW YORK (Bayonne, N. J.)—				
No. 1	.05¼		.05¼	
No. 2	.04¼		.04¼	
No. 4	.04¼		.04¼	

Gas Oil, Diesel Oil and Fuel Oil

(Gas oil per gal., Diesel and fuel oils per bbl.)

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
32-36 gas oil, crack stock	.02⅛	.02¼	.02	.02⅛
U.G.I. gas oil	.02¼	.02⅜	.02⅛	.02¼
32-36, zero to 15 gas oil	.02¾	.02⅞	.02¾	.02⅞
28-30, No. 3 burner oil	1.05	1.10	1.05	1.10
26-30, zero to 10 fuel oil	.95	1.00	.95	1.00
24-26 fuel oil	.75	.77½	.75	.77½
20-22 fuel oil	.70	.75	.70	.75
Below 16 fuel oil	.60	.62½	.60	.62½
NORTH TEXAS—				
32-36 gas oil, industrial	.02¼	.02⅜	.02¼	.02⅜
22-26 fuel oil	.65	.67½	.65	.67½
Below 20 fuel oil	.60	.62½	.60	.62½
NORTH LOUISIANA (Ark., N. La. & Miss. del.)—				
30-32 gas oil, zero	.03	.03⅛	.03	.03⅛
14-16 fuel oil	.70	.75	.70	.75
ARKANSAS (Ark., N. La. & Miss. del.)—				
30-32 gas oil, zero	.03	.03⅛	.03	.03⅛
32-36 gas oil	.02¾	.02⅞	.02⅞	.03
14-16 fuel oil	.65	.70	.65	.70
CHICAGO (based on Oklahoma Group 3)—				
32-36 gas oil, industrial	.02	.02⅛	.02	.02⅛
28-30 zero to 10, fuel oil	1.05	1.10	1.05	1.10
26-28 zero to 10 fuel oil	.95	1.00	.95	1.00
22-26 zero to 10, fuel oil	.82½	.87½	.82½	.87½
18-22 zero to 10, fuel oil	.67½	.72½	.67½	.72½
Below 18 fuel oil	.57½	.62½	.57½	.62½

Note: Fuel oils of more than 40 cold test generally 5 to 15 cents per barrel in all these areas.

PENNSYLVANIA (inland refineries)—				
30-40	.04⅛		.04⅛	
CALIFORNIA—				
Los Angeles:				
30-34 gas oil, per bbl.	1.10	1.26	1.10	1.26
27 plus Diesel	1.10	1.15	1.10	1.15
27 plus Diesel (bunkers)	1.13	1.20	1.13	1.20
12-16 (bunkers at tidewater)	.82½	.85	.82½	.85
10-16 (cargo lots)	.70	.75	.70	.75
12-17 (tank cars)	.62½	.80	.62½	.80
San Joaquin Valley:				
10-18 (tank cars)	.60	.70	.60	.70
San Francisco:				
27 plus Diesel, per bbl.	1.15	1.20	1.15	1.20
27 plus Diesel (bunkers)	1.19		1.19	
10-16 (bunkers)	.90		.90	
GULF COAST—				
28-30 gas oil	.03½	.03⅝	.03½	.03⅝
28-30 Diesel (bunkers)	1.70		1.70	
Bunker C (bulk cargoes)	.85	.90	.85	.90
Bunker C (bunkers)	.95	1.00	.95	1.00
NEW YORK (Bayonne, N. J.)—				
27 plus, gas oil	.04¼		.04¼	
28-30 Diesel (lighterage 6½ cents per bbl.)	1.89		1.89	
28-30 Diesel (tank cars)	.04¼		.04¼	
*Bunker C (to ocean-going ships in N. Y. harbor)	1.15		1.15	
Industrial fuel (tank cars)	.04		.04	

*Lighterage charge 5 cents per barrel additional.

Neutral Oils

(Vis. at 100° F. except Pennsylvania, and color N.P.A.)

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
Zero to 10 Cold Test:				
150-3	.10		.10	
180-3	.11¼		.11¼	
180-4	.10¾		.10¾	
200-3	.11¾		.11¾	
200-4	.11¼		.11¼	
240-3	.13¾		.13¾	
240-4	.13¼		.13¼	
280-3	.14¾		.14¾	
280-4	.14		.14	
300-3½	.15¼		.15¼	
400-4	.17¼		.17¼	
100-2 paraffin oil	.05¾		.05¾	
15-20 Cold Test:				
200-3	.10¾		.10¾	
200-4	.10¼		.10¼	
240-3	.12¾		.12¾	
240-4	.12¼		.12¼	
280-3	.13¾		.13¾	
280-4	.13		.13	
GULF COAST—				
Pale Oils:				
200-3	.07	.07½	.07	.07½
300-3	.07½	.08	.07½	.08
500-3½	.08½	.09	.08½	.09
750-3½	.09	.09¼	.09	.09¼
1,200-3½	.09½	.09¾	.09½	.09¾
2,000-4	.09¾	.10	.09¾	.10
Red Oils:				
200-5-6	.07	.07¼	.07	.07¼
300-5-6	.07¼	.07½	.07¼	.07½
500-5-6	.08	.08½	.08	.08½
750	.08½	.09	.08½	.09
1,200-5-6	.09¼	.09½	.09¼	.09½
CALIFORNIA (moving to domestic market)—				
Pale Oils:				
100-2½-3	.08	.08½	.12½	.14½
200-2½-3	.12½	.13½	.12½	.14½
300-3-3½	.12½	.13½	.12½	.14½
350-3-4	.12½	.13½	.12½	.14½
400-3-4	.12½	.13½	.12½	.14½
450-3-4	.12½	.13½	.12½	.14½
550-3-4	.12½	.13½	.12½	.14½
600-3-4	.12½	.13½	.12½	.14½
Red Oils:				
200-4-5	.12½	.13½	.12½	.14½
300-5-6	.12½	.13½	.12½	.14½
350-5-6	.12½	.13½	.12½	.14½

400-5-6	.12½	.13½	.12½	.14½
450-5-6	.12½	.13½	.12½	.14½
500-5-6	.12½	.13½	.12½	.14½
600-5-6½	.12½	.13½	.12½	.14½
700-6½ plus	.12½	.13½	.12½	.14½
750-6½ plus	.12½	.13½	.12½	.14½
900-6½ plus	.12½	.13½	.12½	.14½
PENNSYLVANIA—				
150 vis. at 70° F., 3 color, 400-405 flash:				
Zero pour test	.23½	.24	.23½	.24
10 pour test	.22½	.23	.22½	.23
15 pour test	.22	.22½	.22	.22½
25 pour test	.21	.21½	.21	.21½
180 vis. at 70° F., 3 color:				
25 pour test	.23½	.24	.23½	.24
200 vis. at 70° F., 3 color:				
Zero pour test	.28½	.29	.28½	.29
10 pour test	.27½	.28	.27½	.28
15 pour test	.27	.27½	.27	.27½
25 pour test	.26	.26½	.26	.26½

Bright and Steam Refined Stocks

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
Bright stocks:				
190-200 D	.17		.17	
150-160 D, 0-10	.14		.14	
150-160 D, 10-25	.13½		.13½	
150-160 24-40	.13		.13	
150-160 E	.13		.13	
Steam refined:				
630 light green (treated)	.07½	.08	.07½	.08
600 light green (untreated)	.06	.08	.06	.08
600 dark green (untreated)	.04½	.07	.04½	.07
PENNSYLVANIA—				
Bright Stocks (Pennsylvania grade, No. 8 color, 145-50 at 210; 540-550 flash):				
10 pour test	.18½	.19	.18½	.19
15 pour test	.17½	.18	.17½	.18
20 pour test	.16½	.17	.16½	.17
25 pour test	.15½	.16	.15½	.16
Steam refined:				
600	.07½	.08	.07½	.08
650	.10	.10½	.10	.10½
600 Pennsylvania flash	.11½	.12	.11½	.12
630 flash	.16	.16½	.16	.16½
600 Warren E filtered	.12	.12½	.12	.12½

Wax and Petrolatum

(Prices per pound)

OKLAHOMA (Group 3)—	Mar. 26		Mar. 19	
124-126 white crude scale	.02	.02¼	.02	.02¼
PENNSYLVANIA (inland refineries)—				
122-124	.0210	.0215	.0210	.0215
124-126	.0215	.0220	.0215	.0220
NEW YORK—				
Wax (a.m.p.) in bags fully refined:				
Refined grades:				
123-135	.0430		.0430	
125-127	.0450		.0450	
128-130	.0475		.0475	
130-132	.0490		.0490	
133-135	.0550		.0550	
135-137	.0575		.0575	
Crude scale:				
124-126 w.s.	.0200	.0225	.0210	.0225
124-126 y.s.	.0190	.0210	.0200	.0215
Petrolatum in barrels in carload lots:				
Dark green	.01⅞		.01⅞	
Amber	.02⅞	.03	.02⅞	.03
Extra amber	.03	.03⅛	.03	.03⅛
Lily white	.06⅝	.06¾	.06⅝	.06¾
Snow white	.07¾	.07⅞	.07¾	.07⅞
Cream	.05⅝	.05¾	.05⅝	.05¾
CHICAGO (based on Oklahoma Group 3)—				
122-124 wax	.0440	.0450	.0440	.0450
125-127 wax	.0465	.0475	.0465	.0475
127-129 wax	.0480	.0490	.0480	.0490
130-132 wax	.0540	.0550	.0540	.0550
132-134 wax	.0565	.0575	.0565	.0575

*Cents per pound on carload orders in burlap bags of 225 lbs. approx. Add 3° F. a.m.p.

Export Prices

GASOLINE

GULF COAST—	Mar. 19		Mar. 12	
U. S. Motor	.04¼	.04⅜	.04¼	
60-62 400	.04⅜	.04½	.04⅜	
61-63 390	.04½	.04⅝	.04½	
64-66 375	.04¾	.04⅞	.04⅝	.04¾
LOS ANGELES, CALIF.—				
U. S. Motor grades:				
53-55 octane	.04	.04¼	.04	.04¼
55-65 octane	.04¼		.04¼	
65-67 octane	.04¼	.04½	.04¼	.04½
67-69 octane	.04½	.04¾	.04½	.04¾
Above 69 octane	.04¾	.05¼	.04¾	.05¼
58-60 400 endpoint	.04½	.05	.04½	.05

KEROSENE

GULF COAST—				
41-43 prime white	.03⅞	.04	.04⅜	.04½
41-43 water white	.04	.04¼	.04½	.04⅝
44 water white	.04¼		.04¾	.04⅞
LOS ANGELES, CALIF.—				
41-43 water white	.04¼	.04¾	.04¼	.04¾

LUBRICANTS

NEW YORK (f.a.s. in bbls.)—				
Cylinder Stocks:				
600 Warren E	.18½	.19	.18½	.19
600 S. R. unfiltered	.14	.14½	.14	.14½
650 S.R. unfiltered	.15½	.16	.16	.16½
600 flash S.R.	.16½	.17	.17	.17½
630 flash S.R.	.20½	.21	.20½	.21
Bright Stocks:				
8 color	.21½	.22	.22	.23
6½ plus colors in dilution	.20½	.21	.20½	.21

NEUTRAL OILS

200-3 color	.30	.32	.32	.34
150-3 color	.25	.27	.27	.28
NEW YORK (prices per pound):				
123-135 a.m.p.	.04125		.0415	
125-127 a.m.p.	.0425		.0425	
128-130 a.m.p.	.0450		.0450	
130-132 a.m.p.	.0425		.0425	
133-135 a.m.p.	.0525		.0525	
135-137 a.m.p.	.0575		.0575	
Crude scale:				
124-126 w.s.	.0200	.0215	.0205	.0220
124-126 y.s.	.0185	.0200	.0200	.0210

Crude Oil Gravity Table

Gravity—	Oklahoma and Kansas 1	North Texas, Central Texas and East Central Texas 2	North Louisiana and Arkansas 3	Gray County, Texas 4	Carson, Hutchinson and Moore Counties, Texas 5	Conroe, Texas 6	Salt Creek, Wyo. 7	Gulf Coast, Texas and Louisiana 8	Gulf Coast, Texas and Louisiana 9	Cotton Valley, Louisiana 10
Below 20	....	....	....	....	....	....	....	$.82	$.82	....
20-20.9	....	....	....	....	....	....	....	.84	.84	....
21-21.9	....	....	....	....	....	....	....	.86	.86	....
22-22.9	....	....	....	....	....	....	....	.88	.88	....
23-23.9	....	....	....	....	....	....	....	.90	.90	....
24-24.9	....	....	....	....	....	....	....	.92	.92	....
Below 25	*$.76	....	....	....	....	....	....	....	....	$.70
25-25.9	*.78	....	....	....	....	....	....	.94	.94	.72
26-26.9	*.80	....	....	....	....	....	....	.96	.96	.74
27-27.9	*.82	....	....	....	....	....	....	.98	.98	.76
28-28.9	*.84	....	....	....	....	....	....	1.00	1.00	.78
Below 29	.84	$.79	$.79	....	....	....	$.84	....	....	....
29-29.9	.86	.81	.81	....	....	....	.86	1.02	1.02	.80
30-30.9	.88	.83	.83	....	....	....	.88	1.04	1.04	.82
31-31.9	.90	.85	.85	....	....	....	.90	1.06	1.05	.84
32-32.9	.92	.87	.87	....	....	....	.92	1.08	1.06	.86
33-33.9	.94	.89	.89	....	....	....	.94	1.10	1.07	.88
34-34.9	.96	.91	.91	....	....	....	.96	1.12	1.08	.90
Below 35	....	....	....	$.79	$.69	....	....	....	....	....
35-35.9	.98	.93	.93	.81	.71	$1.09	.98	1.12	1.09	.92
36-36.9	1.00	.95	.95	.83	.73	1.11	1.00	1.12	1.10	.94
37-37.9	1.02	.97	.97	.85	.75	1.13	1.02	1.12	1.11	.96
38-38.9	1.04	.99	.99	.87	.77	1.15	1.04	1.12	1.12	.98
39-39.9	1.06	1.01	1.01	.89	.79	1.17	1.06	1.12	1.13	1.00
40 and over	1.08	1.03	1.03	.91	.81	1.19	1.08	1.12	1.14	1.02

Effective December 3, 1934, Panhandle Refining Co., purchasing oil in North Texas, posted below 29 degrees, 68 cents; 29-29.9 degrees, 70 cents, with 2 cents added for each additional degree up to 40 and over, at 92 cents.

*The following companies purchasing crude oil in Kansas or Oklahoma, or both, begin their price schedule: Below 25°, 76 cents; 25-25.9°, 78 cents, with 2 cents added for each degree upward to 40 and over at $1.08; Carter Oil Co., Magnolia Petroleum Co., Pure Oil Co., Rock Island Refining Co., Shell Petroleum Corp., Sinclair Prairie Oil Marketing Co., Skelly Oil Co., and Wilcox Oil & Gas Co. All others begin their schedules at below 29°, 84 cents, excepting Phiitex Oil Co., which begins with below 31° at 88 cents.

Column 1—Effective September 29, 1933, Texas Co. of Oklahoma; Stanolind Crude Oil Purchasing Co. in Kansas and Oklahoma; Anderson & Prichard, Inc., in Oklahoma; Bell Oil & Gas Co. in Oklahoma; Carter Oil Co. in Oklahoma and Kansas; Deep Rock Oil Co. in Oklahoma; Derby Oil Co. in Kansas; Globe Refining Co. in Oklahoma; Golden Rule Refining Co. in Kansas; Gypsy Oil Co. in Oklahoma and Kansas; Kanotex Refining Co. in Kansas; Magnolia Petroleum Co. in Oklahoma; Mid-Continent Petroleum Corp. in Oklahoma; National Refining Co. in Kansas and Oklahoma; Shell Petroleum Corp. in Kansas and Oklahoma; Sinclair Prairie Oil Marketing Co. in Kansas and Oklahoma; Texas Co. in Oklahoma; Tide Water Oil Co. in Oklahoma; Vickers Refining Co. in Kansas; Continental Oil Co. in Kansas and Oklahoma; Empire Pipe Line Co. in Oklahoma and Kansas; Phiitex Oil Co. in Kansas and Oklahoma; Pure Oil Co. in Oklahoma; Skelly Oil Co. in Kansas. Effective September 29, by White Eagle Oil Corp. in Kansas; October 1, by Barnsdall Refineries, Inc., in Oklahoma.

Column 2—Effective September 29, 1933, by Texas Co., Stanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Sinclair Prairie Oil Marketing Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Bell Oil & Gas Co., Continental Oil Co. Effective January 14, 1935, in the Van Pool, Van Zandt County, Pure Oil Co. posted below 29°, 79 cents, with 2 cents added for each degree up to 40 and over at $1.03.

Column 3—Effective September 29, 1933, by Texas Co., Magnolia Petroleum Co., Gulf Refining Co. Effective December 22, Stanolind Oil & Gas Co. in Pine Island, Louisiana, and Marion County, Texas, posted below 29°, 79 cents, with 2 cents added for each degree up to 40 and over at $1.03. Effective March 17, 1934, by Standard Oil Co. of Louisiana and Louisiana Oil Refining Co. Starting with below 25°, 71 cents, adding 2 cents for each degree upward to 40 and over at $1.03.

Column 4—Effective September 29, 1933, by Texas Co., Humble Oil & Refining Co., Magnolia Petroleum Co., Sinclair Prairie Oil Marketing Co., and H. F. Wilcox Oil & Gas Co. On same day, Phiitex Oil Co. posted below 31°, 71 cents, with 2 cents added for each degree up to 40 and over at 91 cents. Effective June 1, 1934, Texas Co. (see note above).

Column 5—Effective September 29, 1933, by Texas Co., Humble Oil & Refining Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Wilcox Oil & Gas Co., Continental Oil Co. On same day, Phiitex Oil Co. posted below 31°, 61 cents, with 2 cents added for each degree upward to 40 and over at $1 cents. Effective June 1, 1934, Texas Co. (see note above).

Column 6—Effective September 29, 1933, by Humble Oil & Refining Co. and Tide Water Oil Co., and on September 30 by Texas Co., which on September 29 had posted a schedule of $1.07 to $1.12 with a 1-cent spread on each degree.

Column 7—Effective September 29, 1933, by Stanolind Oil & Gas Co.

Column 8—Effective September 29, 1933, by Humble Oil & Refining Co., Gulf Pipe Line Co., Shell Petroleum Corp., Pure Oil Co., Sinclair Prairie Oil Marketing Co. On October 2, Magnolia Petroleum Co. posted Lockport, Louisiana, 20-20.9°, 84 cents, with 2 cents added for each degree upward to 34 and over at $1.12; and in Cameron Meadows and Iowa, Louisiana, below 20°, 72 cents, with 2 cents added for each degree up to 34 and over at $1.02. These prices were 2 cents higher on each degree than Magnolia prices posted on September 29. Effective September 29, Shell Petroleum Corp. posted in Iowa, Louisiana, district: Below 20°, 70 cents, with 2 cents added for each degree upward to 34° and over at $1; and in Black Bayou and White Castle, Louisiana: Below 20°, 80 cents, with 2 cents added for each degree upward to 34° and over at $1.10.

Column 9—Effective September 30, 1933, Texas Co. (On September 29 Texas Co. has posted a schedule of 2 cents on each degree, but changed it on September 30.)

Column 10—Effective September 29, 1933, by Louisiana Oil Refining Co.

(California Crude Oil Prices on Page 130)

Crude Oil Prices

Oklahoma, Kansas, North Central and East Central Texas

East Texas $1.00
Corsicana (heavy) (June 17, 1933)* ..... .80
Other fields ..... (See gravity table)

Note—In East Texas, effective September 29, 1933, by Texas Co., Sanolind Crude Oil Purchasing Co., Humble Oil & Refining Co., Shell Petroleum Corp., Gulf Pipe Line Co., Tide Water Oil Co., Sinclair Prairie Oil Marketing Co., Magnolia Petroleum Co., Sun Oil Co., Panola Pipe Line Co., Empire Oil & Refining Co., and Atlas Pipe Line Co. posted 60 cents per barrel in East Texas, but on November 3 resumed its posted price of $1 per barrel, making it retroactive to October 22.

*Magnolia Petroleum Co.

West Texas

Crane, Upton, Crockett, Howard, Glasscock, Mitchell (Sept. 29, 1933) ..... $.70
Ector, Winkler and Pecos Counties and Lea County, New Mexico (Sept. 29, 1933) ..... .75
Pecos County, Yates shallow Pool (Sept. 29, 1933)* ..... .65
Jones and Fisher Counties*. See gravity table

Note—Effective September 29, 1933, by Humble Oil & Refining Co., Texas Co., Gulf Pipe Line Co., Shell Petroleum Corp., Magnolia Petroleum Co., and by Stanolind Oil & Gas Co. in Winkler County, Texas.

*Shell Petroleum Corp.

Gulf Coast

Grade A and Grade B specifications discontinued by leading buyers.
..... (See gravity table)
Tomball (see note)* $1.15
Livingston (Sept. 29, 1933)† 1.00
Cleveland (Jan. 11, 1934) 1.00
Greta (Sept. 29, 1933) ..... .85
Refugio, light ..... (See gravity table)
Refugio, heavy (Sept. 29, 1933)‡ ..... .85
Markham and High Island ..... (See Gulf Coast gravity table)
Conroe ..... (See Conroe gravity table)
Bosco, La. (Jan. 18, 1935)§ ..... $.93

Note—Tomball, effective September 29, by Humble Oil & Refining Co. and October 2 by Magnolia Petroleum Co., and November 10 by Stanolind Crude Oil Purchasing Co.

*Greta posted by Texas Co. †Shell Petroleum Corp. ‡Refugio heavy by Humble Oil & Refining Co. Cleveland (Liberty County) posted by Magnolia Petroleum Co. §Bosco posted by Pure Oil Co.

South Central and Southwest Texas

(See note below table)

Darst Creek ..... $.87
Mirando ..... .80
Luling (Sept. 29, 1933) ..... .75
Pettus 1.05
Salt Flat ..... .87
Lytton Springs (Sept. 29, 1933) ..... .95
Duval County (Sept. 29, 1933) ..... .80
Saxet ..... .85

Note—Effective on September 29 by Humble Oil & Refining Co. in Darst Creek, Mirando, Pettus, Salt Flat and Saxet. Effective September 29 in Darst Creek by Gulf Pipe Line Co. and Texas Co. Effective October 2 by Magnolia Petroleum Co. Effective in Pettus and Salt Flat on September 29 by Humble Oil & Refining Co. and Gulf Pipe Line Co. Luling and Lytton Springs by Magnolia Petroleum Co. Duval County by Texas Co. Saxet, effective September 29 by

(Continued on Page 130)

TANK WAGON MARKETS

Quotations for gasoline and kerosene in United States, as furnished by the larger marketing concerns, include taxes

March 26, 1935

Taxes

The gasoline quotations given in the following tables include the 1-cent Federal tax, as well as state, county and city taxes. The gasoline quoted is the regular or standard grade. In most marketing areas a third grade and a premium grade are also available.

Discounts

Under the standard form of commercial consumer contract which went into effect March 1, 1934, save in California, Oregon, Washington, Arizona and Nevada, a discount of 1 cent a gallon off tank wagon or 3 cents a gallon off retail prices is permitted for purchases running between 4,000 and 10,000 gallons a month, or 4 cents a gallon off retail prices for purchase in lots of more than 10,000 gallons a month. The minimum delivery is 25 gallons.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Denver, Colo.	18.0	20.0	5.0	13.0
Pueblo	17.0	19.0	5.0	13.0
Grand Junction	18.5	20.5	5.0	15.0
Casper, Wyo.	18.0	20.0	5.0	11.5
Cheyenne	18.0	20.0	5.0	13.0
Butte, Mont.	21.0	23.0	5.0	17.5
Billings	22 0	24 0	6 0	16.5
Helena	23.0	25.0	6.0	17.5
Great Falls	21.5	23.5	6.0	17.5
Salt Lake Utah	21.0	23 0	5.0	16 0
Boise, Idaho	22.5	24.5	6.0	18.0
Twin Falls	22.5	24.5	6.0	18.0
Albu'que, N. M.	18.0	20.0	*6.5	13.0

*One-half cent city tax.

Effective March 1, 1934, discount to dealers with or without contract throughout Continental territory: Undivided dealer discount off service station price, 4 cents; divided dealer accounts, 3½ cents.

Standard Oil Co. (Indiana)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Chicago	14 6	16 6	4.0	9.0
Decatur, Ill.	14.5	16.5	4.0	9 4
E. St. Louis	14.2	16.2	4.0	9 1
Joliet	14.6	16.1	4.0	9.5
Peoria	14 5	14.5	4 0	9 4
Quincy	14.4	16.4	4.0	9 3
Davenport, La.	14 5	16.5	4.0	9.4
Des Moines	14 4	16.4	4.0	9 3
Mason City	14.7	16.7	4.0	9.6
Sioux City	14.6	16.6	4.0	9.5
Duluth, Minn.	15 3	17.3	4.0	10.2
Mankato	15 0	17.0	4.0	9 9
Minneapolis	15.0	17.0	4.0	9.9
LaCrosse, Wis.	15.7	17.7	4.0	9.9
Green Bay	15.9	17.9	5.0	10.1
Milwaukee	15.8	17.8	5.0	9.7
Madison	16.0	18.0	5.0	9.9
Detroit, Mich.	15.3	17.3	4 0	9 0
Grand Rapids	15 2	17 2	4 0	10 8
Saginaw	15.5	17.5	4.0	11.1
Evansville, Ind.	16 3	18 1	5.0	10.0
Indianapolis	16 4	18 4	5 0	10.1
South Bend	16.7	18.7	5 0	10 4
Fargo, N. Dak.	16.0	18 0	4 0	10 9
Huron, S. Dak.	16 5	18 5	5 0	10 4
Sioux Falls	15 9	17.9	5.0	9.8
Kans. C., Mo.*	13 9	15 9	4.0	7.5
Springfield	13 6	14 8	4 0	7 0
St. Louis	14.2	16.2	3.5	7.5
St. Joseph*	13.9	15.9	4 0	8 8
Wichita, Kans.	13 5	15 5	4 0	6 0
Bartlesville, Ok.	16.8	18.0	5.0	8.5

*State tax 2 cents, 1-cent city tax and 1-cent federal tax.

Discounts to dealers: Undivided accounts, 1¼ cents on premium and regular and 2½ cents on third grade off service station prices; divided accounts one-half cent less than undivided. Where prices are more than 1 cent below normal, the discounts are one-half cent less than above.

Stanolex Furnace Oil in Chicago

Effective Feb. 16, 1935, f.o.b. Chicago tank wagon prices: Range oil, less than 50 gallons, 8½ cents; 50-149 gallons, 7½ cents; 150 gallons and more, 7 cents. No. 1 (36-40 R. stw. zero), less than 100 gallons, 8½ cents; 100-149 gallons, 7½ cents; 150 gallons or more, 7 cents; No. 2 (30-34, stw. zero), less than 150 gallons, 8 cents; No. 3 (32-26, zero), less than 150 gallons, 7 cents; No. 4 (12-16 zero), less than 400 gallons, 7 cents; viscosity of No. 4, 85 at 100° F; No. 5, less than 400 gallons, 6½ cents. For deliveries of more than stated quantities of Nos. 2, 3, 4 and 5, deduct 1 cent.

(Note: Range oil not quoted by Standard; quotation on this product by Burning Oil Distributors Association.)

Southern District

STANDARD OIL CO. (KENTUCKY)

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Atlanta, Ga.	16.0	18.0	7.0	12.0
Augusta	19.0	21.0	7.0	15.0
Macon	19.0	21.0	7.0	13.0
Savannah	17.5	19.5	7.0	14.0
Birm'ham, Ala.	19.5	21.5	8.0	10.0
Mobile	18.5	20.5	8.0	11.0
Montgomery	20.5	22.5	8.0	15.5
Jackson, Miss.	18.5	20.5	7.0	13.0
Vicksburg	13.5	14.5	7.0	14.5
Jack'ville, Fla.	18.5	20.5	8.0	11.5
Miami	18.5	20.5	8.0	13.5
Pensacola	19.0	21.0	8.0	11.5
Tampa	18.5	20.5	8.0	12.5
Lexington, Ky.	18.0	20.0	6.0	11.5
Covington	16.0	17.0	6.0	12.5
Louisville	17.0	19.0	6.0	10.0
Paducah	17.0	19.0	6.0	8.0

In addition to the state tax of 4 cents on gasoline, Montgomery has city and county tax of 2 cents on gasoline and one-half cent on kerosene. Kerosene prices in Georgia and Mississippi include 1 cent state tax; in Alabama, an inspection fee of one-half cent on kerosene and one-fortieth cent on gasoline; in Florida an inspection fee of one-eighth cent on kerosene and gasoline. To Pensacola, Mobile and Birmingham state taxes on gasoline add 1 cent city tax.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Dallas, Tex.	14.0	16.0	5.0	8.0
Fort Worth	14.0	16.0	5 0	8.0
Houston	15.0	17.0	5.0	8 0
San Antonio	13.0	15.0	6.0	8.0
El Paso	16.0	18.0	5.0	10.0
Muskogee, Ok.	16.0	18.0	5.0	8.0
Okla. City	16.0	18.0	5.0	8.0
Tulsa	16.0	18.0	5.0	8.0
Ft. Smith, Ark.	14.1	16.5	5.0	8.0
Little Rock	16.6	19.0	7.5	9.0
Texarkana	14.0	16.0	5.0	8.0

Atlantic Coast District

STANDARD OIL CO. OF NEW JERSEY

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Atl'tic City, N.J.	12.9	16.4	4.0	9.0
Newark	12.2	15.7	4.0	8.5
Annapolis, Md.	14.5	18.0	5.0	10.0
Baltimore	14.0	17.5	5.0	8.5
Cumberland	15.0	18.5	5.0	12.7
Wash'g'n, D. C.	12.0	15.5	3.0	9.5
Danville, Va.	16.5	20.0	6.0	12.9
Norfolk	15.0	18.5	6.0	11.5
Petersburg	15.5	19.0	6.0	11.4
Richmond	15.5	19.0	6.0	11 7
Roanoke	16 5	20.0	6.0	12.9
Charls'n, W.Va.	15.0	18.5	5.0	12.6
Parkersburg	14.0	17 5	5.0	11.2
Wheeling	14.0	17.5	5.0	12.2
Charlotte, N. C.	17.4	20.9	7.0	13.5
Hickory	17.5	21.0	7.0	13.7
Mt. Airy	17 5	21.0	7.0	13.8
Raleigh	17.2	20.7	7.0	13.3
Salisbury	17.5	21.0	7.0	13.6
Charleston, S.C.	15.2	18.7	7.0	11.3
Columbia	17.0	20.5	7.0	13.2
Spartanburg	17.4	20.9	7.0	13.5

Effective October 23, tank wagon gasoline refers to dealer instead of retail prices.

Price basis to dealers: Undivided dealers at regular price less one-half cent. Discount for kerosene, 1 cent off tank wagon price for 25 gallons or more under contract (contract not necessary in Baltimore) except in New Jersey, where no discount is given.

Nebraska

STANDARD OIL CO. OF NEBRASKA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Omaha	16.9	18.9	5.0	10.0
McCook	17.6	19.6	5.0	10.7
Norfolk	17.3	19.3	5.0	10.4
North Platte	17.7	19.7	5.0	10.0
Scottsbluff	18.4	20.4	5.0	11.5

Note: Discounts to dealers; where service station gasoline prices are (maximum overall, including rent) as follows: Reliance, 2½ cents; Standard Red Crown, 3½ cents; Red Crown Ethyl, 3½ cents.

Where service station gasoline prices are below normal, resellers' allowances are reduced one-half of the amount below normal, down to the following (minimum overall, including rent): Reliance, 2 cents; Standard Red Corwn, 3 cents; Red Crown Ethyl, 3 cents. Discounts to consumers for tank wagon deliveries covered only by Standard Commercial Consumers Contract, effective Jan. 1, 1935.

Central South District

STANDARD OIL CO. OF LOUISIANA

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
N. Orleans, La.	16.0	19.5	‡3.0	12.0
Baton Rouge	15.2	18.7	†7.0	12.0
Alexandria	16.1	19.6	†*3.0	10.0
Lafayette	16.3	19.8	‡*3.0	12.0
Lake Charles	16.2	19.7	†*3.0	12.0
Shreveport	14.0	17.5	†7.0	12.0
Knoxville, Tenn.	18.2	21.2	8.0	13.5
Memphis	16.0	18.5	8.0	10.5
Chattanooga	17.5	20.5	8.0	11.0
Nashville	18.0	21.5	8.0	13.0
Bristol	17.0	20.5	8.0	14.0

*Includes city tax of 1 cent.

‡Includes 2-cent parish tax. †Includes 1-cent parish tax.

Effective October 23, tank wagon gasoline refers to dealer instead of retail prices.

Price basis to dealers: Undivided dealers at dealer price less one-half cent.

Louisiana kerosene prices include 1-cent state tax.

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA*

	Gasoline: Tank wagon†	Gasoline: Posted retail	Gasoline: Incl'ds tax of	Kero- tank wagon
San Francisco	16.5	18.5	4.0	12.5
Los Angeles	15.5	17.5	4.0	12.5
Fresno, Calif.	17.0	19.0	4.0	14.0
Phoenix, Ariz.	20.0	22.0	6.0	‡16.0
Reno, Nev.	19.0	21.0	5.0	15.5
Portland, Ore.	19.0	21.0	6.0	13.5
Seattle, Wash.	19.0	21.0	6.0	13.5
Tacoma	19.0	21.0	6.0	13.5
Spokane	22.0	24.0	6.0	13.0

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Prices are at company's plant or depots, as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent.

‡Includes 5-cent state tax.

Pennsylvania, Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Phil'delphia, Pa.	14.0	16.0	4.0	9.0
Pittsburgh	15.0	17.0	4.0	10.0
Allentown	14.5	16.5	4.0	10.0
Erie	15.0	17.0	4.0	9.0
Scranton	15.0	17.0	4.0	10.0
Altoona	15.0	17.0	4.0	10.0
Dover, Del.	14.5	16.5	4.0	10.0
Wilmington	14.5	16.5	4.0	9.0
Springf'd, Mass.	13.0	16.5	4.0	8.5
Worcester	13.0	16.5	4.0	9.0
Hartford, Conn.	12 0	15.5	3.0	8.0
New Haven	12.0	15.5	3.0	8.0
Providence, R.I.	11.5	14.0	3.0	7.5

Note—Tank wagon prices are those applicable to consumers purchasing lots of 100 or more gallons in one delivery.

Canada*

Imperial 3-Star Gasoline

IMPERIAL OIL, LTD.

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Hamilton, Ont.	†22.0	25.0	6.0	17.5
Toronto, Ont.	†22.0	25.0	6.0	17.5
Brandon, Man.	30.3	33.3	7.0	21.8
Winnipeg, Man.	28.7	31.7	7.0	20 2
Regina, Sask.	29.0	32.0	6.0	21.5
Saskatoon, Sask.	31.8	34.8	6.0	24.3
Edmonton, Alta.	31 2	34.2	6.0	23.7
Calgary, Alta.	28.5	31.5	6.0	21.0
Vancouver, B.C.	27.0	30.0	7.0	24.0
Montreal, Que.	24.0	27.0	6.0	17.0
St. John, N.B.	26.0	30.0	8.0	19.5
Halifax, N. S.	26.0	30 0	8.0	19.5

*Imperial gallon used in Canada. †Governed by service station price.

Maritime provinces, all dealers 4 cents off service station price. All other provinces open dealers 3 cents per gallon off service station price (except Toronto and Hamilton cities which are—open dealers 2¼ cents off service station price) 1 cent additional to 100 per cent accounts.

Naphtha

STANDARD OIL CO. (INDIANA)

	Tank wagon*
Oleum spirits	15.7
V.M.&P. naphtha	16.0
Cleaners' naphtha	15.0
Stanisol	15.0

*Prices include 3-cent Illinois tax, but not 1-cent federal tax nor 2 per cent retail occupational tax.

Prices f.o.b. Chicago, March 12, 1935. Each of above prices subject to discount of 1 cent per gallon for 150-gallon lots if covered by contracts.

New York and New England

SOCONY-VACUUM CO., INC.

	Gasoline: Posted dealer	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Albany, N. Y.	12.5	16.0	4.0	8.0
Met. New York	11.75	14.5	4.0	7.75
Br'klyn, Queens	11.5	14.0	4.0	7.75
Buffalo	10.0	12.5	4.0	8.0
Rochester	12.25	15.0	4.0	8.5
Syracuse	12 25	15.0	4.0	8.75
Boston, Mass.	12.5	16.0	4.0	8.0
Portland, Me.	14.5	18.0	5.0	8.75
Manch't'r, N.H.	14.5	18.0	5.0	9.0
Burlington, Vt.	16.0	19.5	5.0	9.0

Ohio

STANDARD OIL CO. OF OHIO

	Gasoline: Tank wagon	Gasoline: Service station	Gasoline: Incl'ds tax of	Kero- tank wagon
Ohio points	16.0	18.0	5.0	*12.5

*Includes state tax of 1 cent, effective July 22.

Retail Price Changes

Regular-Grade Gasoline and Kerosene

Standard Oil Co. of Nebraska, March 22, advanced tank wagon and station gasoline .3 cent in Omaha, McCook, Norfolk, North Platte and Scotts Bluff.

Standard Oil Co. of Louisiana, March 8, reduced tank wagon and station gasoline one-half cent in Chattanooga; March 12, reduced them .4 cent further; March 14, reduced tank wagon gasoline .1 cent and station gasoline .6 cent. March 12, reduced tank wagon and station gasoline one-half cent in Knoxville; March 14, reduced station gasoline one-half cent further. March 14, reduced tank wagon gasoline 1 cent and station gasoline 2 cents in Memphis.

Standard Oil Co. of Kentucky, February 15, advanced tank wagon and station gasoline 1.5 cents in Covington. February 15, advanced tank wagon and station gasoline 1 cent in Lexington. February 15, advanced tank wagon gasoline one-half cent and station gasoline 1 cent and reduced tank wagon kerosene 2 cents in Louisville. February 13, reduced tank wagon kerosene 1 cent in Paducah; February 15, advanced tank wagon and station gasoline one-half cent; February 20, reduced tank wagon kerosene 1 cent; March 13, reduced it 1 cent further. February 21, reduced tank wagon gasoline 3.5 cents and station gasoline 4 cents in Vicksburg; March 4, reduced tank wagon and station gasoline one-half cent; March 9, reduced them one-half cent further. March 12, reduced tank wagon kerosene 2 cents in Birmingham. February 26, reduced tank wagon gasoline one-half cent and station gasoline 1 cent in Atlanta; March 1, reduced tank wagon gasoline one-half cent and station gasoline 1 cent; March 12, reduced tank wagon and station gasoline 1 cent; March 13, reduced tank wagon gasoline 1 cent further. March 15, reduced tank wagon kerosene 2 cents in Macon. March 2, reduced tank wagon kerosene 2 cents in Pensacola.

Standard Oil Co. of New Jersey, March 15, advanced tank wagon gasoline 1.9 cents and station gasoline 2.9 cents in Spartanburg.

Standard Oil Co. of Indiana, March 22, advanced tank wagon and station gasoline .3 cent throughout Michigan, Indiana, Illinois, Minnesota, Iowa, Missouri, Kansas, North Dakota and South Dakota.

Socony-Vacuum Oil Co., Inc., March 12, reduced tank wagon gasoline .25 cent in Albany. February 19, reduced tank wagon gasoline .25 cent in Rochester and Syracuse. March 14, advanced tank wagon and station gasoline one-half cent in Buffalo. March 22, reduced tank wagon kerosene 1 cent in Albany, .25 cent in Metropolitan New York and Brooklyn,

(Continued on Page 48)

Volcanoes Played Important Part in Oil Accumulations

(Continued from Page 30)

which makes 1,295 feet thickness of salt but its total thickness still remains unknown.

Volcanic Rocks Are Expected

From the discussions so far, one can see that any drilling in Northeast Louisiana can hit igneous rocks anywhere below the Midway. Conditions in Monroe have been noted, some mention of volcanics in Richland was made and reference given, and now some others will be discussed briefly and in connection with the numbering set out on the accompanying map:

Monroe and Richland Volcanics (Maps 7 and 8)—In Monroe, drilling and coring established the presence of some 1,200 feet of solid volcanic tuffs and (possibly) flow-rock, between the Midway and the lower Cretaceous.[5-6] This is evidence of volcanic activity during Cretaceous time.

More recently, similar conditions (with fully 1,000 feet of volcanic matter) were found in the Richland gas field.[35]

Northeast Louisiana and Southeast Arkansas (Maps 6 and 9)—In the Floyd (Epps) gas field, East Carroll Parish, volcanic matter is found beneath the "gas rock," and it seems probable that quite an area has this igneous material present immediately below the "gas rock."

In southeastern Arkansas,[32-19] drilling has found igneous rocks beneath a thin layer of "gas rock," or next beneath the Midway. Two of these places are shown on the geological map of Arkansas (Arkansas Geological Survey). In Section 23-17s-2w, Chicot County, the Texas Co.'s No. 1 Hammond ended in igneous rock (peridotite), and the same company's No. 1 Gay, in Section 35-16s-4w, Ashley County, ended in nepheline syenite. The same is true of the Ohio Oil Co.'s No. 1 Jerome Lumber Co., in Section 13-15s-4w, Drew County.

Jackson Gas Field, Mississippi (Map 11)—The Jackson gas field, Mississippi, is known to be on a volcanic pulg. Various wells have proven this. The Louisiana Gas & Fuel Co.'s No. 1 Harris, in Section 35-6n-1e, Hinds County, found weathered Serpentine in a core from 2,984 to 2,996 feet, the top of which was reported as 2,975 feet.

This is mentioned as showing volcanic conditions farther east, but I do not consider it a part of the same basement high described herein as the Northeast Louisiana uplift.

Sharkey County, Mississippi (Map 10) Two wells drilled in Sharkey County, Mississippi[12] found igneous matter. One is in Section 30-11-6w and found the base of the Midway at 3,366 feet, then igneous rocks to total depth of 3,450 feet. Completed March 21, 1929. The other is in Section 14-14-6w, and logged "gas rock" from 3,528 to 3,727 feet, then volcanic matter to total depth of 3,807 feet. May 18, 1932.

Volcanic Rocks and Diamonds (Map 1, also 2 and 3)—There are three volcanoes in the Cretaceous in Arkansas which I have numbered 1, 2 and 3 on the map.[5] The Murfreesboro volcano, Pike County, is where the diamond mines are located. This consists of three or more volcanoes in a single group, whose vents constitute the diamond-bearing blue earth. The diamonds are found in volcanic necks which have come to the surface. The original discovery was made in a cultivated, bottom-land field.

Northeast Louisiana Oil Traps

An interesting possibility presents itself to the wildcatter who drills in Northeast Louisiana. Beautiful diamonds have been found in vents on the Murfreesboro volcano, so it need not be a matter of surprise were he to bring out a core containing a valuable diamond. The bore barrel could encounter such a vent in Northeast Louisiana just as readily as any other volcanic matter, and therefore could bring out a real diamond. If so, give it to the driller.

Regional conditions have been discussed so as to show that a regional high is present. Production will be found only on local structures superimposed on this regional high, or as shoreline pools along its south (possibly north) flank. But before completely disposing of the question of regional high, it may be well to note some oil fields producing on structures due almost wholly to igneous uplifts. I will not discuss such important regions as the Texas Panhandle, and Kansas—the buried granite ridges in these areas are very important economically. I will limit the discussion to a comparison with Cretaceous fields.

There are six Serpentine oil pools in East Texas, where the accumulation of oil is due to local traps, it being considered that the igneous rock was pushed up mechanically through the Cretaceous beds in much the manner salt domes are formed. These are: Thrall,[8] Lytton Springs, Yoast, Dale, Chapman, and Buchanan, with depths ranging from 1,000 to 2,250 feet, and each of small area. Several nonproductive igneous plugs are also known in that part of Texas.

In the Motembo Field of Cuba, a water-clear naphtha is found in Serpentine, but under wholly different structural conditions. My inspection of the Motembo Field leads me to believe there is deep-seated Cretaceous oil, the lighter constituents of which have managed to migrate upwards into this altered and fractured igneous layer—and finally to daylight where it is evaporating. The name Motembo means land of fire.

In a structural way this igneous region of Northeast Louisiana may be considered similar to Thrall, but on a vastly greater scale, so large that production, in the "gas rock," in Trinity beds, or in layers of tuffaceous material, can be expected only in connection with local structures superimposed thereon.

Local structures are not likely to be exhibited at the surface within this province (except through gas seeps such as led to the discovery of the giant Monroe gas field) hence resort must be made to some of the following: (1) Geophysical investigations; (2) systematic core barrel prospecting; (3) more or less random drilling; (4) by drilling a series of tests to the basement beds.

In connection with the discovery of the Floyd (Epps) gas field, located on the line between East and West Carroll Parishes—the easternmost field in North Louisiana—it has been pointed out[34] that the magnetometer, seismograph, and torsion balance each indicated a pronounced structural feature, which is believed to be a body of igneous rock at no great depth. This may be the method by which additional fields will be discovered in this particular territory.

A system of shallow core barrel holes could find any local structures in the Tertiary beds and thus give ample basis for prospecting. However, as noted in these general discussions, it is entirely possible, and quite probable, adequate structures are present at places where they give no reflection in the overlying Tertiary, hence they would be missed completely by such shallow prospecting. Some 10 years ago I joined in drilling four such geological prospect holes, starting in the northeast part of Madison Parish and continuing northward to Lake Providence. That was before regional conditions were so well known, before geophysical methods were developed, and before there was any expectation of finding such a major uplift in the basement rocks that far east.

Since we have three producing fields on this major uplift, it seems probable others remain to be discovered. I see no reason why oil could not be found as readily as gas. Some heavy oil has been found on the Jackson plug, amounting to a total of 1,700 bbls. last year in connection with the gas of that Mississippi Field, and that indicates the possibility of finding commercial oil.

Operators have not been given much information as to the conditions of Northeast Louisiana, Southeast Arkansas and West Mississippi. Pay sands are none too plentiful yet the general regional structure warrants much development work. Deep drilling would not be necessary. Relatively shallow drilling will end in volcanic rocks.

I would say that the best manner of prospecting would be that of drilling several wells, located in proper relationship to each other so as to give the maximum chance of reaching an understanding of local structural conditions. I would not recommend any costly geophysical study for the simple reason that any pronounced high in the basement rocks would likely mean that some igneous plug has reached up into the very base of the Midway and drilling would end in granite without finding any sands.

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[20]Geol. Survey of La., Bull. No. 4, Report of 1905. Geology and Underground Water Resources of NE Louisiana, by A. C. Veatch.

[21]U. S. Geol. Survey, Prod. Pa., 46, 1906. Geology and Underground Water Resources of NE Louisiana and SE Arkansas, by A. C. Veatch.

[22]La. Dept. of Conservation, Bull. No. 9, July, 1921. Monroe Gas Field, by H. W. Bell and R. A. Cattell.

[23]La. Dept. of Conservation, Bull. No. 12, no date. Monroe Gas Field, by H. W. Bell.

[24]Am. Asso. Pet. Geologists, Vol. 12, No. 7, page 765, July, 1928. Production in East Carroll Parish, La., by W. C. Spooner.

[25]U. S. Geol. Survey, Bull. 735-I, April 25, 1923. Diamond-Bearing Peridotite in Pike County, Ark., by H. D. Miser and C. E. Ross.

PIPE LINE CONSTRUCTION

WASHINGTON, D. C., Mar. 25.—Consolidation of two plans for utilizing the wasted gas in the Texas Panhandle today was proposed by Representative Marvin Jones of Amarillo. The plans, as put forward by him, propose to link together the proposition of building pipe lines from the field to St. Louis and Detroit with a program of rural electrification of the area surrounding the field.

This proposal is suggested because of the fact that the entire wastage now going on in the field would not be taken care of by either of the plans alone, Bureau of Mines officials stating informally that the pipe lines would only be able to find markets for approximately 400,000,000 feet per day, whereas the present amount of waste is around 1,500,000,000 feet.

The proposal was brought out in a letter sent by Congressman Jones to R. B. Anderson, Texas State tax commissioner, in which Mr. Jones says:

"After going a little further into the matter I am convinced that the best practical way to handle this would be to make the original act creating the State authority broad enough to include both the pipe line proposal and the proposal to utilize gas locally for the purpose of rural electrification. In other words, the authority to do both could be included in the one act. This would enable the authority to do one or both, and would not interfere in any way with the exercise of either of the powers.

"I understand that the act which created the State authority in connection with the Colorado River also includes authority to utilize the electricity for other purposes. By making the proposed State authority broad and flexible along the lines of that authority, it seems to me it might avoid the necessity of additional action and would not interfere in any way with the proposed activity which the governor had in mind."

Senator Couzens, of Michigan, is also understood to have been in communication with officials of the State with a view to obtaining data and information from them on the subject of waste of natural gas. The senator has pending before the senate a resolution calling for the investigation of the industry which he expects to be favorably acted upon in a few days, and he believes that the investigation may be linked with the proposal to eliminate wastage in the Panhandle by utilizing the gas.

WELDING CONTRACTS AWARDED

H. C. Price, Inc., electric welding contractor, of Bartlesville, Okla., has been awarded the contract for electric welding 88 miles of 10-inch pipe line from Lebec to Torrance, Calif., by the General Pipe Line Co. The general contractors on the job are Macco Robertson & Lang Transportation Co. Price also has been awarded the contract for welding 120 miles of 6-inch pipe from Enid, Okla., to Hutchinson, Kans., for the gasoline pipe line of the Cimarron Valley Pipe Line Co. (Champlin). The general contractor on this job is the B. & M. Construction Co.

New Safety Manual Issued on Bulk Plant Operation

"Bulk Plant Operation and Delivery of Products," the eighth of a series of accident prevention manuals, has been published by the American Petroleum Institute's Department of Accident Prevention. It was prepared by the committee on accident prevention in marketing, and has been approved by the division of marketing general committee, as part of the Institute's work for safety of employes and customers.

The purpose is to provide information for bulk marketing plant operators on safe and efficient methods of operation and delivery, not only for their own protection, but that of the public. It is designed particularly for the benefit of the small bulk plant operator who may be lacking in experience and away from supervision usually available at larger plants.

The manual discusses tank car unloading operations, care of pump houses, warehouses, and platforms; fire protection and fire fighting; safe methods of cleaning storage tanks and tank trucks; safe practices in making deliveries to customers; and careful operation of trucks to avoid accidents.

Application of Calorized Refinery Pipe Still Tubes

By C. L. CLARK[1], ROGER STEWART BROWN[2] and A. E. WHITE[3]

While a steel must always possess sufficient strength or load-carrying ability to withstand the applied stress without undergoing more than a definite, fixed deformation, there are also many cases in which a good degree of oxidation or corrosion resistance is necessary. Results from creep tests and from commercial practice have shown that certain of the low-alloyed, pearlitic type steels possess sufficient creep strength for continuous service at temperatures of 1,000 to 1,200° F., and also for short-time over stressing at considerably higher temperatures. These steels usually do not possess a suitable resistance to oxidation and, in general, they are badly attacked by the sulphur compounds in sour crudes.

In order to obtain the necessary degree of resistance against sulphide corrosion and severe oxidation, it has been common practice to resort to the relatively high-alloyed steels. This procedure has two disadvantages. First, steels of

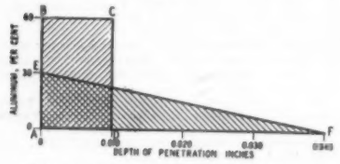


Fig. 1—Diagrammatic sketch of the two steps in the calorizing operation

this type are usually expensive and the savings resulting from their use may be largely offset by the increased initial costs; and second, certain of them possess certain inherent detrimental properties which limit their field of usefulness.

It appears, therefore, that the field of application of certain of the low-alloyed, pearlitic steels could be widely extended, especially in connection with the refining of sour crudes, if their surface were to be protected by some material which was highly resistant to both sulphide corrosion and oxidation. Aluminum is known to fulfill this condition, not only as a virgin metal, but also when it is alloyed with steel, provided, of course, that a sufficient amount of aluminum is present in the iron-aluminum alloy. The formation of this iron-aluminum compound on the surface of steel is known as Calorizing. It should be emphasized that Calorizing is not a mere plating or covering of steel with aluminum as a definite solution of the aluminum in the iron is obtained.

The art of Calorizing is by no means new and Calorized materials have been available for many years. In the earlier method a very thin layer was formed on the surface which, because of its extremely high aluminum content, was brittle. As a consequence, this layer often cracked in service due either to the expansion of the tube during operation, to the thermay stresses set up in the tube wall, or to the action of the tube cleaner. As soon as this happened, the protecting action of the layer was destroyed.

New Method

A new method of Calorizing was recently developed[4] which eliminates this difficulty as it produces a coating of considerable thickness which has sufficient ductility to permit a relatively large deformation without cracking and suitable shock resistance to withstand the thermal stresses and the action of the tube cleaner. This method consists of two processes. In the first, the part to be Calorized are heated in a closed retort with the usual Calorizing mixture. They are Calorized in the usual manner and an iron-aluminum alloy is formed on the surface which contains 50 to 75 per cent aluminum over a depth of 0.005 to 0.010 inch. This step is represented by the shaded rectangular section of Figure 1. This layer, however, is brittle, because of its high aluminum content, and there is a distinct line of demarcation between the aluminumized surface and the underlying steel, along which there is a tendency for the surface layer to spall off if the article is subjected to deformation.

The Calorized parts are then placed in closed retorts and heat treated. This causes a penetration of the iron-aluminum alloy into the material, as represented by the triangular section of Figure 1. In this way the high aluminum concentration of the thin surface alloy is reduced to a point (about 30 per cent A1) where the alloy becomes sufficiently ductile to permit the required deformation, and the line of demarcation is entirely obliterated, thus leaving no plane of weakness.

The depth of penetration, and thus the thickness of this layer, varies somewhat, depending upon such factors as the chemical composition and grain size of the steel being used, but it averages approximately .040 inch. The two photomicrographs of Figure 2 show typical micro-structures of this layer at a magnification of 100 diameters. The one designated as (a) is a plain carbon steel of the 1015 type, while the other is a low-alloy steel of the chromium-molybdenum-silicon type, known commercially as Timken DM. The extreme outer surface, varying in thickness from 0.0076 to 0.009 inch, is somewhat porous, but it is the underlying material which imparts the oxidation and corrosion resistance.

[4]U. S. Patent 1,988,217.

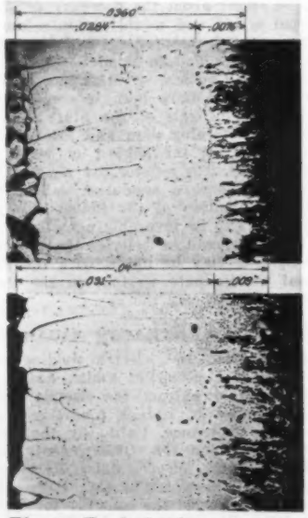


Fig. 2—Typical micro-structures of the calorized coating enlarged to 100 diameters. Upper, plain carbon steel type 1015. Lower, chromium - molybdenum - silicon alloy known as Timken DM.

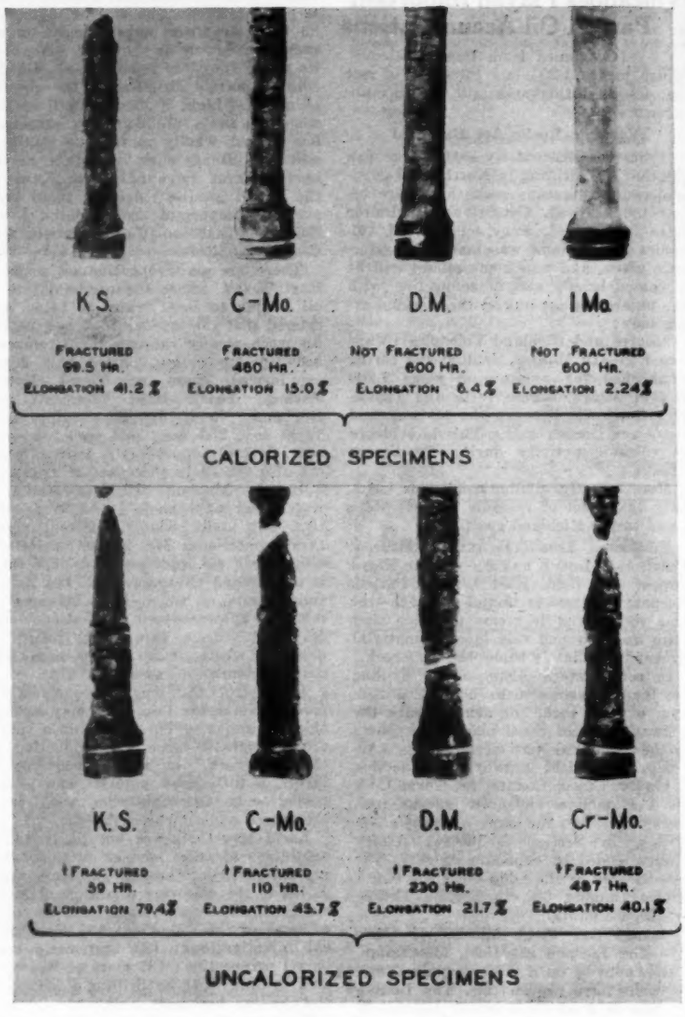


Fig. 3—Comparative load-carrying ability of calorized and uncalorized steels at 1400° F. and 2000 lbs. per sq. in. load.
1 Mo. Carbon-Molybdenum (1.0 Moly)
K. S. Killed Mild Steel — C-Mo. Carbon-Molybdenum (.50 Moly.)
D.M. Timken D.M. Steel — Cr.-Mo. 4-6 per cent Chromium plus .50 Moly.
†Partly caused by reduction of section by scaling.

Properties of Materials

While the present Calorized layer possesses a sufficient degree of ductility for most applications it will, of course, crack under excessive deformation. For the most satisfactory service it is, therefore, necessary to select a base material which possesses sufficient creep strength or load-carrying ability to withstand the applied stresses. In other words, the base material supplies the strength and the Calorized layer, the oxidation and corrosion resistance. In order to determine more fully the properties of this coating when applied to various low-alloyed steels, a rather expensive series of investigations were undertaken.

Standard Creep Tests

In order to determine the actual load-carrying ability of these Calorized steels at elevated temperatures, creep tests were undertaken on the standard units of the University of Michigan, which are capable of detecting elongation changes of 2.8 millionths of an inch. The single-step method of loading was employed with at least four different stresses being used for each steel at each temperature. All tests were continued for at least 1,000 hours. The specimens were first machined to size, except for the threaded portions, and were then Calorized. The threads were cut after the Calorizing operation. The specimens had a gauge length of 2 inches and a diameter of 0.505 inch.

The results obtained from certain of these tests are given in Table 1. The steels considered are mild carbon steel of the 1015 type, two carbon-molybdenum steels which contain 0.50 and 1 per cent molybdenum, respectively, and Timken DM, which is a chromium-molybdenum-silicon alloy. For comparative purposes results are also included at 1,200° F. for a steel of the 4-6 Cr. + Mo type. The temperatures considered ranged from 1,100 to 1,400° F. as it is believed tube fractures often occur at these more elevated temperatures, due to coke deposition causing overheating.

Although values are included for three different creep rates, it is believed that for this type of service greater emphasis is generally given to the creep rate of 1 per cent per 10,000 hours. If the steels are compared on this basis, a rather wide variation exists in the stresses required at each temperature, depending upon the alloying content. At 1,200° F., steel DM

[1]Research engineer, department of engineering research, University of Michigan.
[2]Vice president, the Calorizing Co.
[3]Director, department of engineering research, University of Michigan.

possesses the greater strength; at 1,300° F.; DM and the 1 per cent Moly. steels are approximately equal; while at 1,400° F., the 1 per cent Moly. steel is somewhat superior.

Stress-Rupture Tests

In order to show more clearly the differences in the load-carrying ability of these various Calorized steels, specimens of each were subjected to identical loads at a given temperature and the tests continued until fracture of some of them was obtained. The load selected was based on the stresses which are encountered in certain commercial applications. Similar tests were also conducted on certain of the uncalorized specimens in order to determine the influence of Calorizing on the load-carrying ability. The tests were conducted in a vertical, electrical furnace and although the ends were packed with asbestos, a certain amount of air seeped into the furnace.

Figure 3 shows results obtained at 1,400° F. under a stress of 2,000 pounds per square inch. These tests were conducted for a maximum of 600 hours, and during this period all of the uncalorized specimens fractured. The maximum time, 487 hours, was required by the 4-6 cr. + Mo steel while the mild steel required the least, 59 hours. Two of the Calorized specimens, mild steel and 0.50 Moly., also fractured in 99.5 and 480 hours, respectively. The DM elongated 6.4 per cent in the 600-hour period and as a result its Calorized coating was cracked. The 1 Moly. steel, however, only elongated 2.24 per cent during this time period and no cracks appeared in the Calorized coating. These findings, therefore, offer further support to the statement made above, that is, that from 5 to 6 per cent deformation is required to produce cracking of the Calorized layer.

If the results from the uncalorized and Calorized specimens are compared it will become evident that Calorizing increased the load-carrying ability in all cases. It is believed that the improvement in load-carrying ability obtained by Calorizing can be largely attributed to the increased resistance to oxidation rather than to an actual increase in the strength of the Calorized specimen.

Sufficient tests of this type are to be undertaken to enable the determination of complete stress-time for rupture curves for each of these materials at 1,300 and 1,400° F. This phase of the work is not as yet completed. Figure 4, however, does show a curve of this type for DM steel at 1,400° F. This curve appears to become asymptotic to a stress slightly below 2,000 pounds per square inch.

Tensile Properties

Tensile tests were conducted on some of the Calorized specimens in order to determine the influence of this operation on the strength and ductility characteristics. For comparative purposes similar tests were also conducted in certain cases on the uncalorized materials. The results obtained are shown in Table 2.

The results indicate the ductility to be somewhat lowered by the Calorizing operation and especially is true with the reduction of area values. The decrease is not sufficiently pronounced, however, to classify these materials as brittle. For example, in the Calorized condition, the elongation ranges from 31.3 to 32 per cent and the reduction of area from 29.2 to 35.7 per cent. The strength characteristics are in general slightly increased by the Calorizing operation.

Hardness Tests

Another of the outstanding advantages of a Calorized surface, in addition to its resistance to corrosion and oxidation, is its high surface hardness which enables it to resist erosion and the action of the tube cleaners. Because of the thickness of the coating, the ordinary penetration type hardness tests do not give a true picture of the actual surface hardness. The most suitable for measuring the hardness has been found to be of the scratch type, such as the Bierbaum scratch hardness test.

Specimens of five different Calorized steels were subjected to this type of test and the results obtained are given in Table 3. Hardness determinations were made at three different positions in the Calorized coating as well as in the ferrite of the base material. The sections chosen in the Calorized coating were near the outer edge, at the center, and near the junction of the Calorized coating and the base material.

Values for the micro-hardness of the Calorized coating range from 300 to 800, while the corresponding values for the ferrite in the base material ranged from 150 to 200. The entire cross-section of the Calorized coating is, therefore, considerably harder than the ferrite in the base material.

The results indicate the hardness of the Calorized coating to vary, depending upon the depth from the outer surface. In every case the section near the junction showed the minimum hardness and this would be approximately .040 inch from the outer surface. In certain cases the outer surface of the Calorized coating possesses the maximum hardness while in other cases the maximum hardness occurred at a point more near to the center of the coating.

TABLE 1—CREEP CHARACTERISTICS OF CALORIZED STEELS AT INDICATED TEMPERATURES

Material—	Temp. °F.	Stress for rate of creep of 1 per cent in designated time period, hours: 100,000	10,000	1,000
Mild steel	1,100	1,050	2,050	4,100
0.50 Moly.	1,100	2,700	7,000	15,000
DM*	1,200	1,950	3,950	8,100
4-6 Cr. + Mo*	1,200	900	2,500	5,250
0 50 Moly.	1,200	470	1,650	5,800
1.00 Moly.	1,200	1,100	2,600	6,200
DM	1,300	700	1,800	3,900
0.50 Moly.	1,300	210	840	1,900
1.00 Moly.	1,300	840	2,000	4,800
DM	1,400	250	560	1,100
1.0 Moly.	1,400	380	750	1,475

*Uncalorized.

TABLE 2—EFFECT OF CALORIZING ON THE TENSILE PROPERTIES AT ROOM TEMPERATURE

Material and condition—	Tensile strength lbs./sq. in.	Yield point lbs./sq. in.	Elongation per cent in 2 in.	Reduction of area per cent
Carbon (K), Uncalorized	60,000	35,000	40.5	66.8
Carbon (K), Calorized	65,000	35,000	32.0	31.8
Carbon (O), Uncalorized	49,700	25,000	46.0	67.0
Carbon (O), Calorized	52,500	28,750	31.3	29.2
1.0 Moly., Calorized	52,575	32,500	31.5	35.7

K = Steel of the killed type.
O = Steel of the open or rimmed type.

TABLE 3—HARDNESS OF CALORIZED COATINGS

Material	Position in Calorized coating—	Bierbaum hardness: Width of scratch Microns	Micro-hardness
DM	Near outside edge	3.944	650
	Center	4.000	610
	Near junction	5.754	300
	Ferrite in core	7.200	200
Bain	Near outside edge	4.332	525
	Center	4.400	510
	Near junction	5.431	325
	Ferrite in core	8.233	150
0.50 Moly.	Near outside edge	4.483	500
	Center	3.578	800
	Near junction	5.000	400
	Ferrite in core	7.371	190
1.00 Moly.	Near outside edge	4.267	550
	Center	4.267	550
	Near junction	5.790	300
	Ferrite in core	8.400	150
1015	Near outside edge	4.800	425
	Center	4.310	530
	Near junction	5.140	390
	Ferrite in core	8.090	160

TABLE 4—OXIDATION RESISTANCE

Type of material—	Samples	1,200° air gain in wgt. mg./sq. cm., total 1,000 hours: Plain	CZ.	1,800° air gain in wgt. mg./sq. cm., total 48 hours: Plain	CZ.
18-8	1	1.1	0.52	1.2	2.0
Tubing	2	....	0.75	2.5	1.0
4-6 per cent cr.	1	17.5	1.58	80.3	1.4
1 per cent Tungsten	2	....	1.40	78.5	1.6
4-6 per cent cr.	1	36.6	0.88	117.8	2.4
0.45-0.65 per cent Moly.	2	....	0.71	111.2	1.7
4-6 per cent cr.	1	39.5	0.56	126.3	1.8
	2	....	0.71	123.0	Loss
Plain	1	70.8	0.80	134.2	2.5
Low carb. steel	2	....	0.92	128.0	2.1
Carbon-Molybdenum	1	83.6	0.99	127.7	1.8
0.50 per cent Molybdenum	2	....	0.94	126.5	2.9

NOTE—None of the Calorized samples showed attack by oxidation. The slight gain or loss in weight on Calorized specimens results from formation of a protective surface film.

TABLE 5—GAIN IN WEIGHT—MILLIGRAMS PER SQ. CM.

Type of material—	Samples	Gain wt. per mg./cq. cm.—24 hours—900° F. hydrogen sulphide (6% H_2S): Plain	CZ.	24 hours—1,200° F. hydrogen sulphide (H_2S pure): Plain	CZ.
18-8	1	0.29	0.036 Loss	1.11	0.52
Tubing	2	0.42	.....	....	0.75
4-6 per cent cr.	1	0.57	.....	17.5	1.58
1 per cent Tungsten	2	0.58	.....	....	1.40
4-6 per cent cr.	1	0.65	0.12 Loss	36.6	0.88
0.45-0.65 per cent Moly.	2	0.68	.....	....	0.71
4-6 per cent cr.	1	0.35	0.02 Loss	39.5	0.56
	2	0.33	.....	....	0.71
Carbon-Molybdenum	1	1.76	0.033 Loss	83.6	0.99
Molybdenum 0.05 per cent	2	....	.....	....	0.94
Plain low	1	1.02	0.035 Loss	70.8	0.80
Carbon steel	2	0.95	.....	....	0.92

NOTE—None of the Calorized samples showed attack either by oxidation or sulphur corrosion. The slight gain or loss in weight on Calorized specimens results from formation of a protective surface film.

Oxidation Resistance

To make use of the high creep strength of the newer alloy steels, it is necessary, however, to be sure that the section will remain intact during the life desired. In general those temperatures (1,100° and up) which necessitate a stronger tube than killed mild steel also cause rather rapid oxidation of the tube exterior. None

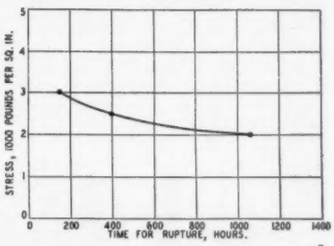


Fig. 4—Stress-time rupture curve at 1400°F.

of the low alloyed pearlitic steels have appreciable oxidation resistance at 1,200° F. The newer type of heavy duty Calorizing will protect any of these steels from scaling at continuous temperatures up to 1,500° F. and for short periods even as high as 1,700° F.

In Table 4 is presented the oxidation resistance of a number of these materials both plain and Calorized.

Sulphur Corrosion Resistance

In handling corrosive stocks cracking still tubes frequently fail by corrosion from the inside. In Table 5 is given the comparative corrosion resistance of the various low alloy steels, plain and Calorized. We have not found any laboratory test which will exactly duplicate the relative standing of these metals in refinery corrosion. In pure hydrogen sulphide gas, the 4 to 6 per cent chrome steels are attacked more readily than in an actual cracking still. The problem of laboratory accelerated tests is further complicated by the fact that in refinery service any corrosion products formed are soon scoured off by the tube cleaners exposing fresh surface.

It is at least apparent from these hydrogen sulphide tests that the Calorized steel is immune to corrosion from hydrogen sulphide up to 1,200° F., and in any concentration, which fact is verified by refinery use.

Erosion of Tubes

While the heavy duty Calorized surface has ductility (5 per cent elongation), it is extremely hard and may even be used to scratch glass. Providing that the turbine cleaners of either the Star wheel type or drill head or "knockers" are kept moving—they do no more than remove the surface roughness.

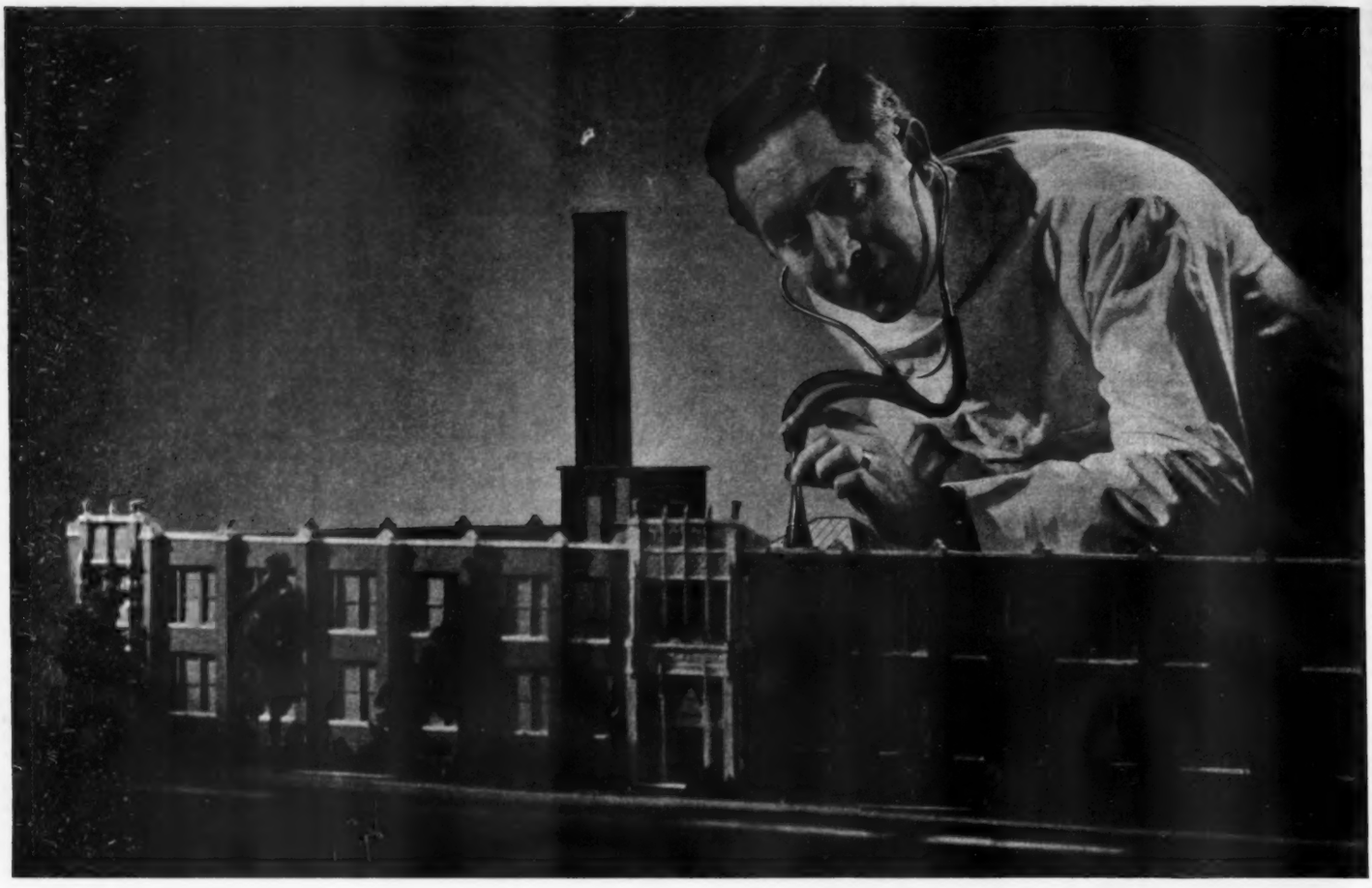
Recently, at a prominent mid-western refinery the following wear test was made: The cleaner was traversed through the tubes at the rate of 5 feet per minute.

On the first test cutters of the milling head type, with new cutter wheels were employed—a new, separate tool for the Calorized and plain steel tubes. Seventy passes were made then all cutter wheels were renewed and 30 additional passes taken.

At the end of this test one-thirty-second inch was worn from the wall of the mild steel tube and the ground in front of the bench littered with particles of steel torn from the tube wall. The heavy duty Calorized tube showed no wear and took a nice polish under the action of the cleaner.

Following this test both cleaners were equipped with Acorn or knocker type

(Continued on Page 129)



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NEWS FOR PETROLEUM REFINERS

Construction Begun on New Rail and Water Terminal

MUSKEGON, Mich., Mar. 26.—Construction of the new $175,000 western Michigan gasoline storage plant and combined rail and water distribution terminal was started in Muskegon last week under the direction of Hoyt H. Hollister, chief engineer of the White Star division of the Socony-Vacuum Oil Co., Inc., of New York.

Grand Trunk Western Railway employes started work on a new 700-foot railroad siding and the Dobb Trucking & Transfer Co. moved in equipment to start grading, excavation and dirt dyke construction.

Contracts for laying a double 6-inch pipe line 1½ miles long over the Belt Line Railway right-of-way to the Grand Trunk car ferry dock at the foot of McCracken Avenue where a new tanker wharf also will be built, for the pipe and for construction of an initial 148,000 bbls. of tankage also have been let.

Several carloads of pipe have arrived from the Youngstown Sheet & Tube Co.. Coolsaet Brothers, of Dearborn, Mich., started laying the pipe line this week.

The Chicago Bridge & Iron Works will start to erect the first three tanks, including two large spheroid tanks with capacities of 60,000 and 80,000 bbls., respectively, and a smaller 7,700-bbl. tank about April 1.

Contract for construction of a piling wharf on the east side of the Grand Trunk commercial slip will be let soon.

Don Glass, special construction engineer, conferred with Mr. Hollister, engineer in charge, and will be on the job at intervals throughout construction. The large tanks, first of their kind to be erected in Michigan, will comprise the first unit of a possible tank farm of double the original capacity on a 14-acre tract.

Large Socony-Vacuum Co. tankers will enter the Muskegon harbor within six or eight weeks to discharge their cargo through the double pipe line into the storage tanks where a warehouse, office and loading platforms for rail and motor truck shipments throughout western Michigan also will be erected under contracts also to be let soon.

Pumping Station Site Is Picked for Gasoline Line

A tract of land east of Hutchinson, Kans., has been sold by the Carey Salt Co. to the Champlin Refining Co. for the site of a pumping station on the proposed pipe line to be laid between Enid, Okla., and Superior, Neb. Construction of the station will begin soon.

Tanks, loading racks for trucks to pick up gasoline, and track facilities will also be located on the tract, it was reported. The ground is situated on the Hutchinson and Northern railroad, giving it connections to main lines of the Santa Fe, Rock Island.

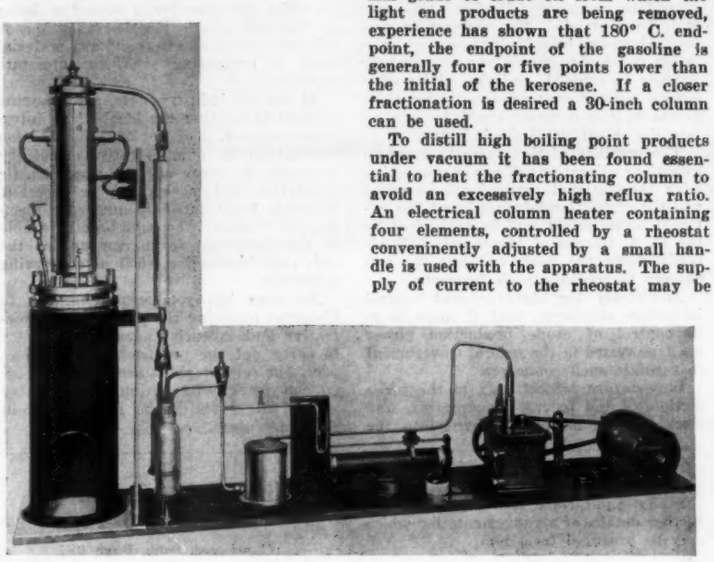
Gurley Appointed Omar Refinery Superintendent

The appointment of O. D. Gurley as superintendent of the Garber, Okla., refinery of the Omar Refining Co. was announced recently by F. S. and J. H. Whittaker, owners of the company. Before his resignation, Mr. Gurley was superintendent of the Blackwell refinery of the Globe Oil & Refining Co. He has served in the same capacity for Globe at the McPherson, Kans., and Lemont, Ill., refineries and for the Pure Oil Co. at Cushing, Okla.

Laboratory Vacuum Distillation Unit Determines Refining Value of Crude

A specially designed laboratory apparatus for vacuum distillation of oils has been perfected in London, England. The laboratory equipment which has also been installed at refineries in Europe, is used in testing work by the firm which has acted as consultant for several refining organizations for several years. The first unit was built in 1930 and since that time it has been improved and modified as its uses in laboratory work increased.

The main features of the equipment are shown in the accompanying illustration. It is constructed entirely of steel and no jointing material has been used, the joints being constructed and ground until a satisfactory fit is obtained. No packing is employed except in the head thermometer of the fractionating column where a gland containing asbestos packing is used.



All-metal vacuum distillation unit used to analyze crude oils for lubricating oil content

The vacuum still, fractionating column and accessory equipment are finished with a heavy chromium plate. The interior of the still bottom is chromium plate in order to facilitate cleaning. The set is mounted on two boards; one supports the motor and vacuum pump assembly and the other the remainder of the apparatus including a needle valve by-pass for vacuum control and also a special air dryer.

The still can be supplied with bottoms of various sizes. The normal operating capacity is 3 or 4 liters. Provision is made for the admission of live steam, should it be necessary, through an open coil so that the unit is available for steam distillation.

The Standard fractionating column for the apparatus is 18-inch, packed with Harrington cones. When distilling a normal grade of crude oil from which the light end products are being removed, experience has shown that 180° C. endpoint, the endpoint of the gasoline is generally four or five points lower than the initial of the kerosene. If a closer fractionation is desired a 30-inch column can be used.

To distill high boiling point products under vacuum it has been found essential to heat the fractionating column to avoid an excessively high reflux ratio. An electrical column heater containing four elements, controlled by a rheostat conveninently adjusted by a small handle is used with the apparatus. The supply of current to the rheostat may be varied by means of a two-position switch, so that the apparatus may be worked over a wide temperature range. The electrical supply to the column is so adjusted as to maintain a definite temperature difference between the temperature of the oil in the still and the vapor temperature at the top of the column.

Considerable trouble was experienced in testing out a number of types of automatic pressure control gear. It was found that when distilling without the use of steam, the pump and motor usually supplied will maintain a steady absolute pressure of 4 mm. of mercury, while closer control is obtained by means of a very fine needle valve adjusted by the

(Continued on Page 133)

Semiannual Meeting of N.P.A. in Cleveland

The regular semi-annual meeting of the National Petroleum Association will be held at the Cleveland Hotel, Cleveland, Ohio, on April 18th and 19th. There will be two general sessions—the first on the afternoon of Thursday, April 18th, and the second on the morning of Friday, April 19th. A carefully arranged program for these two general sessions has already been made and the names of the speakers will be announced within the next few days. Important group conferences will be held on Wednesday evening, April 17th, and on Thursday morning, April 18th.

TEXAS CO. HOLDS MEETING

Terminal division superintendents of the Texas Co., Refining department held their forty-seventh annual meeting at Jacksonville, Fla., last week. Exchange of ideas on operating questions and the discussion of efficient methods of operation were the outstanding features of the meeting.

Prominent officials of the Texas Co. who attended the meeting included A. E. Manley, general superintendent; W. B. Williams, assistant general superintendent; C. D. Morris, engineering department; R. Amundsen; A. R. Nicholson, manager personnel department; J. F. Sheeran, personnel department, and Miss S. S. Frank, secretary to Mr. Manley, all of the New York City office.

Inland and Pentagon to Build Michigan Refineries

Michigan Refining capacity will be increased to 28,500 bbls. a day by the construction of a new 1,000-bbl. plant at Pontiac to be started immediately by the Inland Refineries, Inc.

E. G. Guy, formerly of Muskegon, who had many years experience in Oklahoma and Texas before coming here to build and operate the Old Dutch Refinery, has designed and will direct construction of the new Pontiac plant which will operate entirely on Michigan crude oil.

Mr. Guy has just completed construction of the McClanahan Refineries, Inc., plant of 2,000 bbls. daily capacity at St. Louis, Mich., which increased the market for Michigan crude to 27,500 bbls. a day. The Pentagon Refining Co. now has a 1,500-bbl. plant under construction in the Detroit area at Plymouth. This is included in the 27,500-bbl. total, a figure which does not include, however, the large White Star plant at Trenton, Mich., near Detroit.

The Inland plant will be erected on a 13-acre tract between the Grand Trunk Railroad and the Dixie highway. Mr. Guy has been named a director of the company. Officers are: President, Carl L. Skidmore; vice president, Paul Martin and secretary-treasurer, Benjamin F. Hall.

Other Michigan plants now total 14, including 11 already operating with a combined capacity of 24,500 bbls., two shut down with capacities of 1,500 and 300 bbls., respectively, and the Pentagon plant of 1,500-bbls. under construction.

English Coal Hydrogenation Plant Has Begun Operations

Operations commenced recently at Billingham-on-Tees, England, in the first unit of a plant producing gasoline from coal on a commercial scale. This operation is the outcome of work started about four years ago on an experimental plant. The commercial plant, and the intervening experimental and research work, are estimated to have cost approximately $20,000,000. It is planned, after testing commercial operation in the single unit and making necessary adjustments, to gradually place additional units in operation. By the end of June the entire plant is expected to be operating to capacity, with a gasoline output from British coal of around 30,000,000 gallons a year.

The British government has given a guarantee of a tax preference equivalent to 12 cents a gallon as against imported gasoline, and it is stated the production price will be under 14 cents a gallon. The government is especially interested in the project as a potential source of fuel oil for naval purposes.

Pennsylvania Grade Crude Oil Association Meetings

The Pennsylvania Grade Crude Oil Association announces the following schedule of meetings to be held with jobbers, distributors and dealers of Pennsylvania motor oils in the several territories:

City—	Hotel	Date
Boston	Parker House	Apr. 8
New York	McAlpine	Apr. 9
Philadelphia	Benjamin Franklin	Apr. 10
Baltimore	Lord Baltimore	Apr. 11
Pittsburgh	William Penn	Apr. 12
Cincinnati	(Not yet selected)	Apr. 15
Indianapolis	Lincoln	Apr. 16
Cleveland	Statler	Apr. 17
Detroit	Statler	Apr. 22
Chicago	Blackstone	Apr. 23
Minneapolis	Curtis	Apr. 24
Kansas City	President	Apr. 26
Omaha	(Not yet selected)	Apr. 27
Denver	Brown	Apr. 30

John E. Shatford Chosen to Succeed Howard Bennette

WASHINGTON, D. C., Mar. 25.—The Planning and Coordination Committee today approved the name of John E. Shatford for appointment as national co-ordinator of refinery operations to fill the post left vacant by the death of Howard Bennette. Appointment of Mr. Shatford will not be final until approved by President Roosevelt. The term of service will continue until June 16, the code expiration date.

JOHN E. SHATFORD

Mr. Shatford became a member of the Planning and Coordination Committee April, 1934, and has served on numerous subcommittees since that time. During the illness of Mr. Bennette, Mr. Shatford has acted as alternate co-ordinator and has fulfilled all the duties of the post almost since the inception of the position.

Washington Concerned About Agency for Coordination Under Compact

By HUGH D. MALLON
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Mar. 25.—Now is the time for the industry to come forward with plans for setting up a co-ordinating agency to further the principles in the interstate compact in the opinion of some congressional, as well as industrial leaders. It is the opinion of these men that the compact, standing alone, will not benefit the petroleum industry to as great an extent as would be possible if a co-ordinating agency were set up which would bring together the national views which the federal Government alone is able to express, and the local views which, by the terms of the compact, will be left to the states.

One congressional spokesman has said that unless action is taken by the industry to set up such an agency the compact will fail, due to the fact that the states, by themselves, cannot control or regulate interstate commerce. Without this control, he contended, the compact is useless. However, he said, if necessary legislation continuing regulatory powers over imports is enacted, and the advice of a federal agency on production allocations is taken, the compact could be worked into the salvation of the industry.

The inability of the states to synchronize their allocations of crude production with the national demand was stressed and the suggestion advanced that the national figure might well be arrived at by the U. S. Bureau of Mines, which is already doing the work and has the machinery to continue such forecasts.

Admittedly the states cannot control interstate shipments, and if there is to be control of crude production power must be vested in the federal Government to regulate such commerce.

Imports are subject only to the jurisdiction of the federal Government, and since imports must be figured into the national demand for crude some form of regulation must be devised. It has been suggested that this duty also might well be placed in the hands of the Bureau of Mines, and consideration given to imports in the periodical forecasts of demand.

Besides this there must be set up a governing body of representatives from the compacting states, with rules and regulations covering the scope of the authority vested in this group, and setting up the conditions under which they can act. An agency should also be organized in the states to assist the state representatives in carrying out the orders of the governing body, as well as aid in the enforcement of the provisions of the conservation program.

That it is up to the industry to get behind such a program is indicated by a statement by Governor Marland of Oklahoma, sponsor of the compact plan, in which the governor is quoted as being of the opinion his position as governor will not permit him to spend any material time in organizing such an interstate agency.

If the oil industry now, after having worked to fruition the ideal of an interstate compact, does not continue the job and set up the administrative machinery necessary to carry out the plan, drastic legislation by Congress may be expected. This has been stated by numerous members of Congress who have been favorable to the movement for a compact as the only constitutional method of conserving petroleum.

No plan has yet been submitted to Congress outlining the proposed administrative and executive agencies necessary to carry out the provisions of the compact, but several plans are under consideration by groups within the industry which will doubtless be forthcoming in the near future.

All Exhibit Space Taken for Oil Show in Houston

All exhibit space has been contracted for the annual Oil Equipment & Engineering Exposition which will be held in Convention Hall, Houston, Texas, from April 8 to April 13 inclusive. Manufacturers from various sections of the country will have their products on display and the show is expected to attract large numbers of oil men from throughout this country as well as representatives from abroad who are interested in new methods and practices and improvements made in equipment used in all branches of the petroleum industry.

E. G. Lenzner, general manager of the exposition promises a number of unique features which will be of interest and educational value to those attending the displays. First aid contests will be held and oil men will be given an opportunity to witness the best teams of the various oil companies in action. A special display has been arranged of new and novel inventions of interest to oil men.

Oil men who attend the oil show may not know they are trappers but they have been so designated by John R. Suman, vice president in charge of production for the Humble Oil & Refining Co. and who, on the side, is chairman of the Wildcat Committee of Houston. Mr. Suman, after investigation and research, and communication with the Federal authorities in Washington, learned that the hide of the wildcat is in its best condition during the month of April, and that April is the best month in which to trap the wildcat.

Consequently, the "convention of trappers" will hold its annual banquet and gridiron on the evening of April 11 in the city auditorium in Houston. The auditorium has facilities for handling comfortably 2,000 persons. Mr. Suman feels gratified at having been able to procure the city auditorium for the convention, further details of arrangements for which may be procured from him.

Texas House Approves Pact and Market Demand

AUSTIN, Tex., Mar. 25.—The house Monday passed finally three bills important to the oil and gas industry. The Latham-Calvert bill codifying the oil conservation statutes and extending the market demand provisions of the law until September 1, 1937, was passed finally by a vote of 112 to 1.

The Tennyson bill to declare gas pipe lines common carriers 90 days after the effectiveness of the act was passed finally without a record vote.

The Daneil bill to adopt the interstate oil compact was passed finally by a vote of 110 to 1. Clarence E. Farmer of Fort Worth, who voted against both measures, declaring his belief they would increase the price of gasoline to the consumer.

The compact measure was amended to include a declaration that the provision for congressional approval shall not be construed as surrendering to the Federal Government any control over production.

The house adopted a motion of Sidney Latham to lay out the Stanfield gas waste bill as pending business. The bill may be called up for consideration as soon as pending measures are cleared. The Stanfield bill, prepared by a subcommittee after long hearings, is designed to regulate in all particulars the production of natural gas and to reduce gas waste to a minimum through curbing of the practice of stripping gas for its natural gasoline content and of limiting the uses of natural gas in the manufacture of carbon black.

Gasoline Holds Ground in Group 3 Territory

(Continued from Page 38)

dently fearing cancellation of orders from their customers because of moderated weather conditions.

Cracking stocks were up, largely because refiners with cracking plants were beginning to operate them and had no stock to sell, thus creating a mild scarcity.

Bright and steam-refined stocks and neutrals were in satisfactory demand and some refiners were reported in filling orders. Wax was weak and there were reported to have been price concessions.

OHIO OIL STATIONS

Uniformity of design and maximum visibility from the roadside as well as from the station interior are two major objectives in plans for a chain of stations which it has been commissioned to construct for the Ohio Oil Co. of Findlay, Ohio, according to G. A. Bryant, Jr., executive vice president of the Austin Co. of Cleveland.

Construction will be of metal and glass type, with porcelain enamel exterior and interior on prefabricated metal panels with red and white porcelain colors. The wall sections will be doubly insulated to reduce heat loss to a fraction of that occurring in standard residence construction and one-twelfth of the loss through ordinary uninsulated metal panels. Each unit will require about 15 tons of iron and steel, the roof alone weighing 2½ tons.

Provisions for service and comfort include a spacious lubritorium where the patron will be able to witness the servicing of his car without fear of brushing against greasy equipment, a large waiting room, modern rest room facilities, accessories salesroom and storage quarters.

The stations will cost approximately $100,000 and are to be completed this spring. They will be scattered throughout northwestern Ohio.

Control Bill Unneeded Says Colonel Thompson

WASHINGTON, D. C., Mar. 26.—Col. E. O. Thompson, chairman of the Texas Railroad Commission, in a statement issued today, bitterly assailed the Thomas oil control bill now pending before the senate committee on mines. The colonel branded the bill as unnecessary, unconstitutional, a brake on recovery in the oil industry, an attempt to change the system of government by divesting the states of their sovereign rights, in contravention of President Roosevelt's public utterances, and the entering wedge for regimentation of all industry which is opposed by the overwhelming majority of the industry. The bill for these reasons should be killed in the committee, Colonel Thompson said.

He pointed out that the present flow of hot oil has been "reduced to an irreducible minimum," that the various state agencies are adequately controlling the situation, and that the governors of nine oil states have entered into a compact to conserve the supply and prevent the waste of oil which makes the bill entirely unnecessary.

The indirect method of controlling production by quotas to be shipped in commerce, which is unconstitutional in the colonel's opinion, should not be written into the statute books, Mr. Thompson said, and he cited numerous court decisions upholding his contention as to the illegality of the proposed measure.

In alleging that the bill violates the rights of state sovereignty, Colonel Thompson quoted a paragraph from a letter addressed by President Roosevelt, under date of April 3, 1933, to the governors of the oil producing states in which the President said:

"I especially direct your attention to Paragraphs A-1 and A-2 of the recommendations of the Committee of Fifteen. It is obvious that the action proposed to be taken in these paragraphs is within the sole authority and jurisdiction of the interested states. The President of the United States has no authority to declare a moratorium such as is proposed and he might be regarded as infringing on the sovereignty of the states if he should make the request contained in Paragraph A-2."

The two paragraphs referred to in the letter requested the President to suggest to the governors of the oil states that they close down immediately all flush fields in their states, and to also call upon the same governors to enact adequate conservation statutes.

TANKER OPENS SEASON

The Standard Oil Co. (Indiana) tanker, Beaumont Parks, for the second successive year opened the bulk freight navigation season into the Muskegon Harbor last week when it entered with the first cargo of gasoline for the company's western Michigan storage tank farm and distribution center on the Muskegon Harbor.

The Parks docked in Muskegon on Sunday, March 17, after a path through about a quarter of a mile of harbor ice was broken by the Grand Trunk Western Railroad carferry, Madison. The Parks also was the first bulk freighter to enter the western Michigan port in the spring of 1934, but a week later, on March 25.

RETAIL PRICE CHANGES

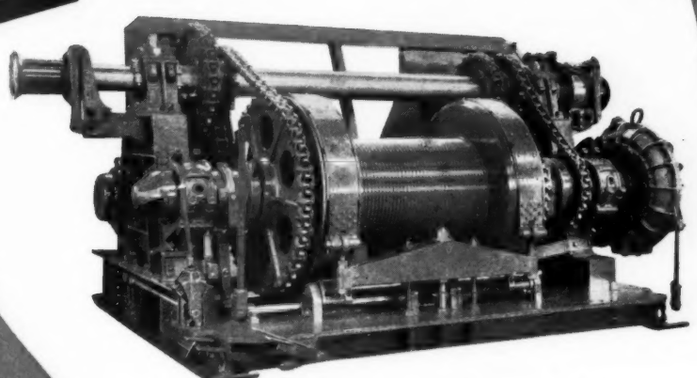
(Continued from Page 42)

Queens, and one-half cent in Burlington.

Standard Oil Co. of Ohio, March 21, advanced tank wagon and station gasoline one-half cent throughout Ohio.

Magnolia Petroleum Co., March 22, advanced tank wagon kerosene 2 cents in Muskogee and one-half cent in Oklahoma City and Tulsa.

EMSCO



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FOR DEEP WELL DRILLING

The Emsco Type UH-54-A Unitary Drawworks is the largest and heaviest drawworks produced to date by Emsco. With the Unitary type frame, which is bolted direct to concrete foundation, there is no necessity for tying in with any members of the derrick, thus insuring lack of vibration, positive and rigid brake support, and materially reducing setting-up time in the field.

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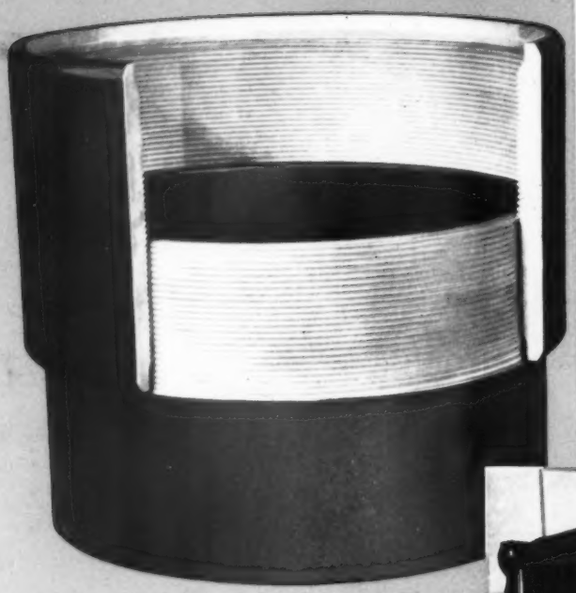

A section of pipe on which threads have been perfectly cut with a threading tool produced by the Youngstown precision method.

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AN ACHIEVEMENT

The Zeiss Projecting instrument projecting the form of the threads. Magnifications of thread-form from ten to one hundred times their actual size are possible on this machine.

In the production of Youngstown oil country pipe, the same master tool is used for making the tools which thread the pipe and the tools which thread the couplings. Microscopic studies have conclusively proved the perfection of the matched threads achieved by this process. Youngstown is the only pipe producer in the United States equipped for this accuracy of control.

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YOUNGSTOWN

Natural Asphalts Used Long Before Refined From Crude

(Continued from Page 32)

is based on personal observations by the writer in the United States, Cuba, Mexico and Venezuela and on the description of various writers elsewhere. It is impractical to give credit to each writer in this brief article but their work is acknowledged as a whole. For those who wish more detailed data reference is made to Abraham, Herbert, Asphalt. See also the accompanying map of the western hemisphere.

NORTH AMERICA

Canada

Alberta Province—The very extensive "tar sands" of Canada are along the Athabaska and Clear Water Rivers. The beds are reported to be as thick as 225 feet and are found over an area of 750 square miles.

Manitoba Province—Asphalt beds in the Clear River district.

United States

The United States exceeds by far in the number of occurrences and their wide distribution.

California — There are very extensive deposits in California. They are in the following counties: Kern, Mendocina, Monterey, Santa Cruz, San Luis Obispo, and Santa Barbara. In Santa Barbara there are some of the most remarkable deposits in the world. They are remarkable for their fossil remains.

Alabama — Colbert County along the Tennessee River.

Arkansas — Pike County and Sevier County.

Kentucky — Kentucky ranks next to Oklahoma in the number of asphalt deposits and their distribution. They are in the following counties: Breckenridge, Carter, Edmonson, Grayson, Hardin, Logan, and Warren.

Louisiana—Lafayette Parish.

Missouri—Lafayette County.

Oklahoma — Oklahoma has a greater number of asphalt deposits and they are distributed over a greater area than any other region in the world. There are 70 known occurrences of asphalt in the southern part of the state. They are in the following counties: Atoka, Carter, Caddo, Comanche, Garvin, Jefferson, Love, LeFlore, Johnston, McCurtain, Murray, Marshall, Pontotoc, Pushmatha.

Oregon—Coos County. There is an asphalt like substance from coal in the old Ferry's mine at Riverton.

Texas—Asphalt occurs in three counties namely: Burnette, Montague, and Uvalde.

Utah—Utah not only has very extensive veins of high grade asphalt but also has a greater variety of hydrocarbon residues than any other area. They include the Ozocerite (mineral wax), Gilsonite, and crude asphalt. They are in the following counties: Boxelder, Carbon, Utah and Uintah.

Wyoming—Big Horn County.

Mexico

Tamaulipas—Seeps along Tamesi River and along Panuco River west of Tampico.

Vera Cruz — Seeps of asphalt in the vicinity of Tuxpan, near the head of the Tuxpan River, extensive deposits in the Tepetate oil fields.

Cuba

Province of Matanzas—Asphalt in Sarentine near Santa Catalina, and soft asphalt in Guametos district.

Province of Santa Clara—Asphalt near Cata.

Province of Camaguey — Beds near Minas about 30 miles from Neuvitas.

Province of Havana—Near Bejucal 18 miles south of Havana.

Province of Santiago — There is hard asphalt in the Victoria de las Tunas district. Cuba has more asphalt seeps with less oil than any other country.

SOUTH AMERICA

Colombia

Province of Boliver—There are numerous seeps along the Carribean Sea south of Cartagena.

Province of Santander—Asphalt is reported north of the Sogamoso River, also at Morokai, and at Las Monas.

Province of Boyaca—Asphalt occurs at Tunja, Macheta, Tuta, Paipa, Pesca, Lapuerta, Popago.

Venezuela

State of Zulia—There are various beds of asphalt about Lake Maracaibo, along the east shore of the lake. They must have come from the pools of heavy asphaltic oil below. There are other beds along Rio Limon southwest of the lake.

State of Bermudez—The asphalt lake near Guonoco is the largest in the world. It covers more than 1,000 acres and the maximum depth is 40 to 50 feet. The asphalt is a sticky mass which yields when walked on. Over the surface of more than a square mile there are many vents from which the asphalt seeps. Wells drilled for oil under the lake have had moderate success. On the island of Capure in the delta of the Orinoco is a seep one-eighth mile wide and one-half mile long.

State of Zamora — In the foothills of the Andes west of Pedraza there is asphalt.

Trinidad

On the west side of the island of Trinidad is the famous Pitch Lake. It covers about 140 acres and has a maximum depth of 160 feet. The asphalt is a very dark brown slightly plastic mass containing a considerable per cent of sand, clay and shells. It is in a fault zone and near an oil pool. Though this is not the largest asphalt deposit it is the best known because it is easily reached and in a country which otherwise delights the traveler.

Argentine

Province of Jujay — There is asphalt northeast of Jujay.

Province of Chubut—There is asphalt in the Comodoro Rivadavia oil field. A review of the asphalt beds described above shows that there is a chain of them almost completely surrounding the Gulf of Mexico and the Carribean Sea. When considered with the Gulf Coast oil fields this body of water may be considered the "Basin of Petroleum."

Asphalt occurs in the countries of Europe and Asia listed below:

Europe

France, Italy, Greece, Portugal, Spain, Russia, Albania, Germany, Switzerland, Rumania, Jugoslavia, Austria Hungary.

Asia

Eastern Russia (Island of Sakhalin), Japan, the Philippine Islands.

Africa

Algeria, Nigera, Rhodesia, and Madagascar.

COMPETITOR OF OIL

A London inventor is said to have perfected, after 10 years' work and an expenditure of $150,000, a process for the production of high-grade gasoline from minerals by low-temperature distillation, at a cost of 4 cents a gallon. The inventor claims he can extract gasoline from any mineral containing oil without treating it with oil. The best mineral for the purpose is said to be torbernite, previously regarded as worthless. It is found in enormous quantities in England, Australia and South Africa. The best quality yields 150 gallons of oil a ton. An extraction plant will be erected in South Africa. It is said the gasoline produced by this process has been tested in automobiles and airplanes and has been found to give a greater mileage ratio than present-day gasoline.

J. C. PATTERSON DIES

PETROLIA, Ontario, Mar. 25.—Joseph Carson Patterson died here recently, aged 75. Coming to Lambton County as a young man, Mr. Patterson was for many years a driller in the Canadian Fields.

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Instruments Important in Control of Modern Refinery Processes

By NEIL WILLIAMS

HOUSTON, Tex., Mar. 25.—Increasing demands in modern refining for greater exactness in control have placed added responsibilities upon instrumentation. In earlier refining it may not have been essential to pay so much attention to this phase of operation, but due to the many factors involved in refinery practices of today, provision of more adequate instrument facilities, together with proper installation and maintenance of instruments, is becoming of more and more vital importance.

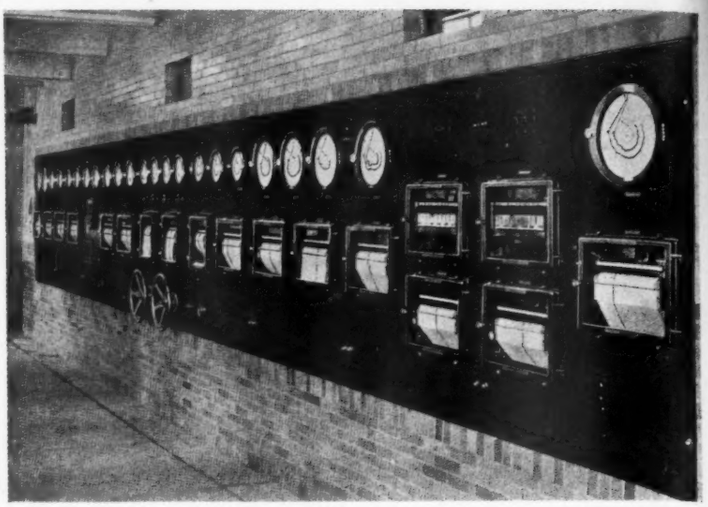
Perhaps too few refiners have given instruments the consideration they warrant. To a large extent they have been looked upon as more or less minor equipment. Frequently installations have been made in a haphazard fashion with comparatively little regard to the selection of the most suitable types of equipment for particular purposes. Insufficient attention is often given the location of instruments with respect to convenience or protection from the elements, most efficient manner of installation, general appearance of the instrument panel or board, and last but not least proper servicing and maintenance of the instruments after installation.

The dangers involved in the improper installation of instruments in modern refining and the failure of refiners to service and maintain their instruments in the best of shape can be readily appreciated. Faulty instruments not only result in inefficient and inaccurate control of specifications of products but constitute serious hazards when controlling high pressures and temperatures. Costs of refinery operation also are directly related to the control by instruments of temperature and fuel consumption.

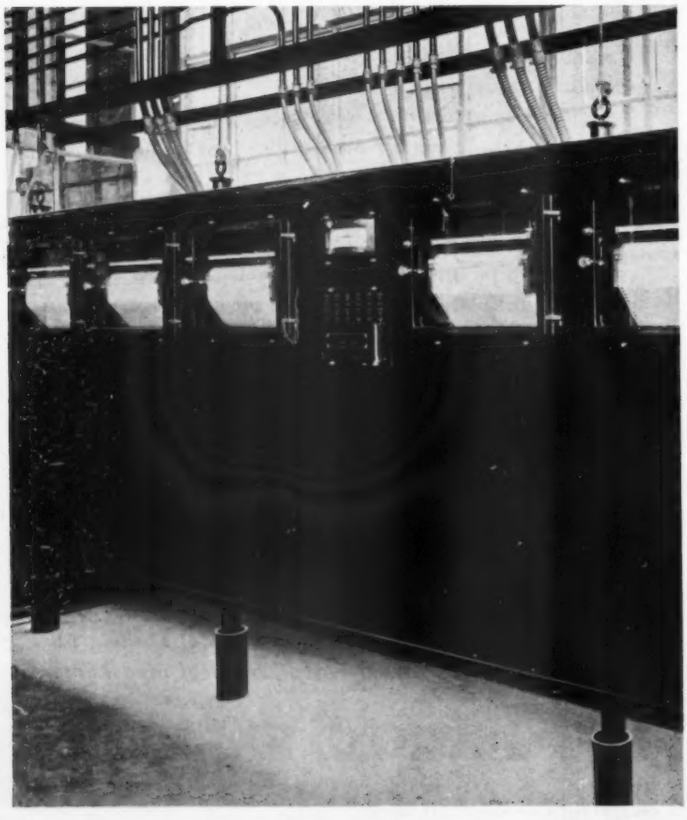
Consistent servicing, including frequent checking and adjustment; prompt attention to replacement of parts; and replacement of old and antiquated equipment are phases essential to the proper maintenance of instrument facilities. Such care and attention play an important part not only in increasing the accuracy of control necessary in modern refinery practice but also go a long way in prolongation of the life of instruments.

Trained Instrument Men

The importance of such attention is making more and more necessary the services of trained instrument men. For the most part it is becoming less possible for men not especially familiar with instruments to make the exact adjustments now required, particularly with the newer and more complicated instruments. In line with this, some of the larger companies now employ full time service men, the majority of whom have been trained in instrument construction, operation and maintenance, in the employ of manufacturers of instruments. It is estimated that one trained full time man can look after 30 instruments.



Well designed installation for modern large sized refinery with separate instrument and control room



Latest type of recording instruments installed where there is considerable plant vibration due to engines and pumps. The instrument board is suspended on springs and mounted on oil-cupped shock absorbers. All wiring is in conduits with flexible connections to instruments

The life of an instrument depends on the following main factors, namely: the age of the instrument in respect to its model; type of instrument; application of the instrument; type of service and maintenance, and the nature of installation.

In the first place, an instrument may be new so far as usage is concerned when it is installed, but if it is an old model or type its life may be antiquated or cut short by the rapid advancement in refinery operating practices and by the newer and improved types of instruments which continually are being brought out. In such cases, an old model instrument may have to be replaced before it really is worn out.

Second, in respect to types of instruments, indicating instruments are of such construction that they have very little to wear out or become antiquated; consequently they have much longer lives of serviceability than control or recording instruments, which are of more complicated and involved with moving parts.

Third, in the application of instruments, certain phases of refinery operation place greater usage upon instruments than others and consequently shorten the lives of instruments. Fourth, instruments which are constantly watched and checked and serviced naturally have longer lives than those which are not cared for.

Fifth, proper initial installation is essential to prolongation of instrument life, as has been mentioned previously. Instruments which are protected from the elements, from vibration and shock and other possible damage naturally have a better chance of outlasting installations in which no consideration is given these factors.

It has been estimated conservatively that the average life of a refinery instrument is seven years. Under ordinary circumstances an instrument serving that length of time should be replaced with new equipment to insure reliability and accuracy of refinery operation. Naturally, some instruments should be replaced much sooner than that, while others can be kept in service for longer periods, this to be determined by conditions.

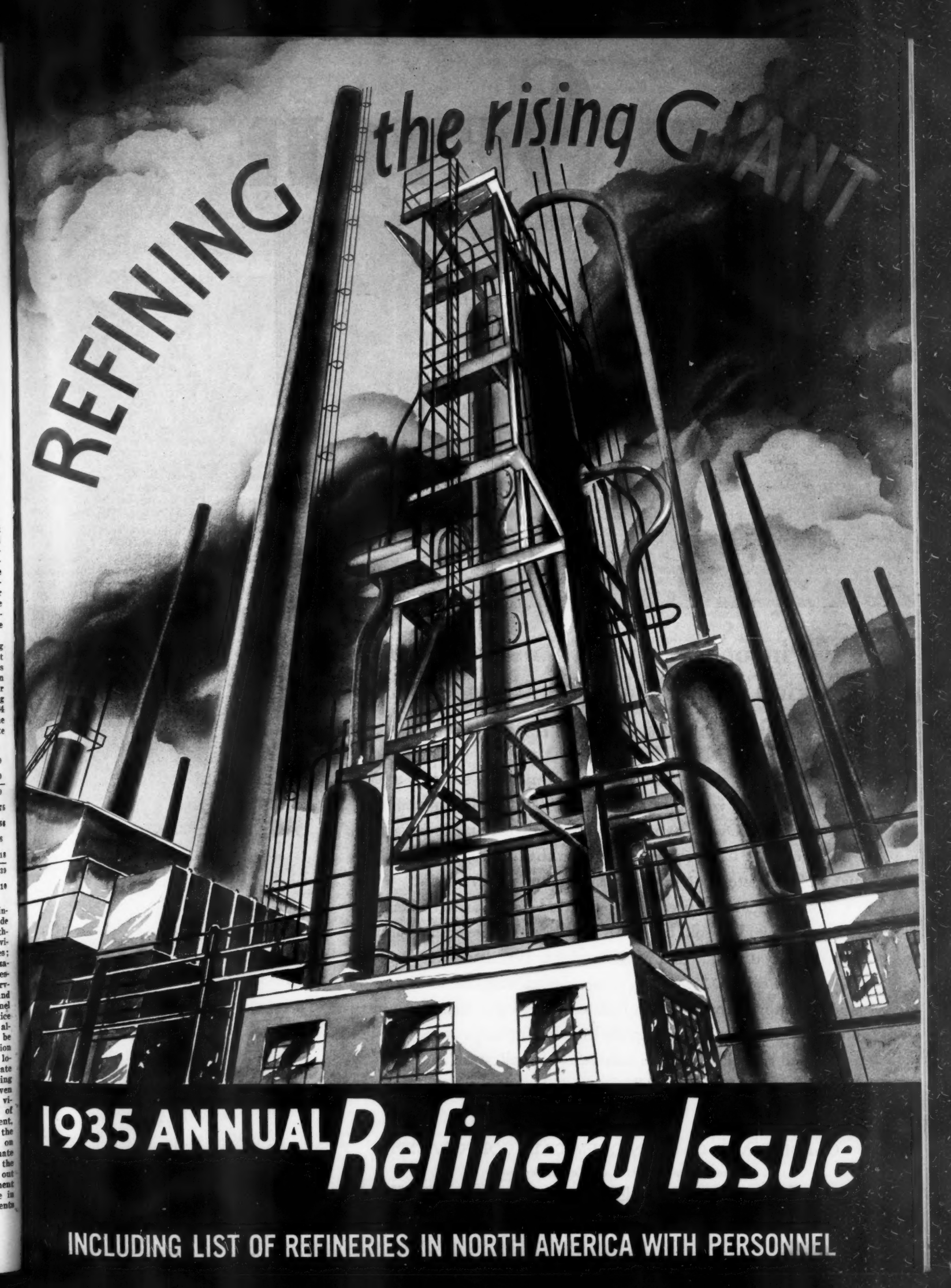
Quite likely, the newer instruments being brought out will result in an increase in the average life. Manufacturers constantly are improving their instruments. A growing knowledge of requirements is enabling them to adapt their instruments to better service, and at the same time the development of better materials and methods of construction and workmanship is resulting in the production of instruments of more substantiality and ruggedness. Also better and more standardized test methods are being devised and service facilities increased which are to the advantage of the newer equipment.

Although instruments now are being looked upon as one of the most important parts of refinery equipment, their cost is comparatively small. On the basis of an average life of 10 years for the newer instruments, a single point recording pyrometer probably costs less than 24 cents a day. This is indicated in the following table of estimated, approximate costs:

Cost of new pyrometer	$250.00
Trade-in value at expiration of 10 years	*25.00
Depreciation cost for 10 years	$225.00
Depreciation cost per day (3,000 days of operation)	.075
Average daily cost charts, ink, ribbons, etc.	.066
Average daily cost other accessories (thermocouple replacements, etc.)	.03
Plant service per day (one man at $150 per month for 30 instruments)	.018
Total daily average cost	$0.239

*Based on code trade-in allowance of 10 per cent of original purchase price.

Factors to be considered in proper initial installation of instruments include protection of the instruments from weather and the elements; minimization of vibration and shock from outside sources; convenience of location and centralization of instruments and control; accessibility of instruments and leads for servicing; substantiality of installation, and general appearance of instrument panel board and lay-out. In earlier practice instruments generally were placed in almost any position which happened to be available. More and more consideration now is being given by refiners to the locations, and in many instances separate instrument and control rooms are being provided where ample protection is given the equipment. Where there is much vibration and shock due to movement of pumps, engines and other equipment, special attention is being given to the installation of instrument boards on springs or shock absorbers to eliminate the transmission of the vibration to the recording charts. Systematic laying out of the instrument board and arrangement of instruments also is of importance in facilitating reading of the instruments and control of operations.



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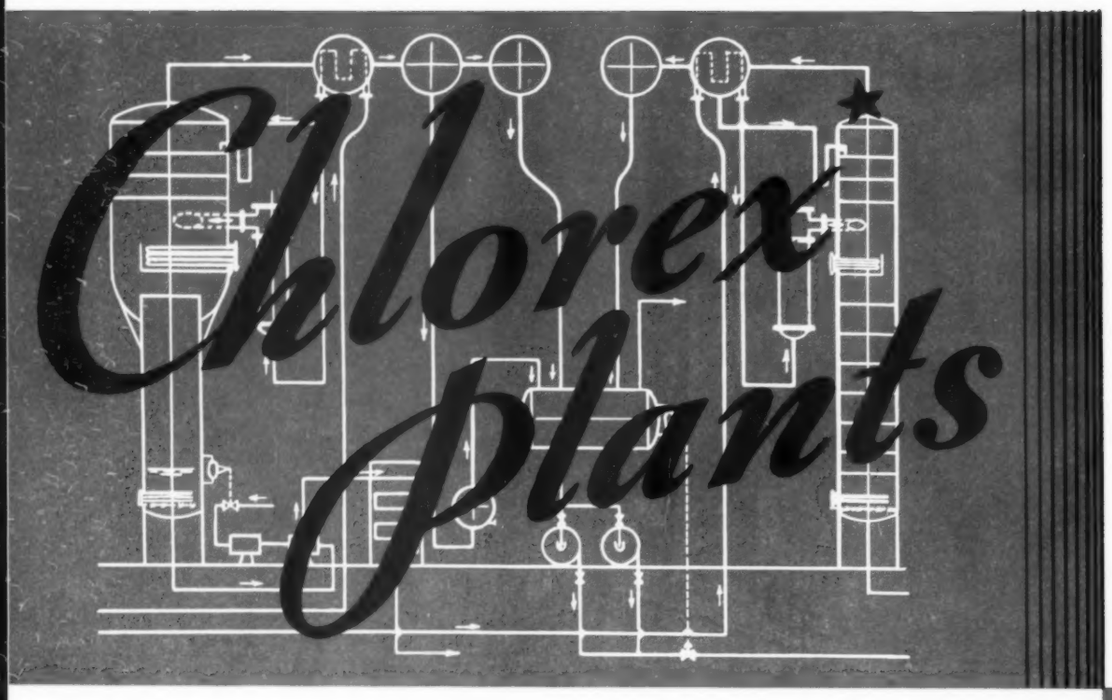
INCLUDING LIST OF REFINERIES IN NORTH AMERICA WITH PERSONNEL

Now Seven



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Five in operation — two more under construction — A combined charging capacity of over 6000 barrels of lubricating stock daily

. . . more Chlorex units than plants for any other selective solvent extraction process in use in the United States for the treatment of lubricating oils. Over fifty million gallons of better oils have been produced by the Chlorex process—more than two hundred million quarts of oils better suited to modern engine requirements.

Chlorex is manufactured only by Carbide and Carbon Chemicals Corporation and is sold under an exclusive license from Standard Oil Company (Indiana) and Mid-Continent Petroleum Corporation.

During the last 12 months, experimental extractions of a wide variety of lubricating stocks submitted by refiners in this country and abroad have served to materially broaden the scope of the Chlorex process and knowledge of the technique of application and recovery of the solvent. Complete details are available. You will not obligate yourself in any way by writing for them.

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Low Plant Investment—A 1000-bbl. per day Chlorex plant, new from the ground up, using continuous vacuum distillation for solvent recovery, may be installed within a cost range of $90 to $110 per barrel charging capacity. Four Chlorex plants, using stills already available for recovering the Chlorex, were constructed at an average cost of $41 per barrel.

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Applications—Commercial use has proved the Chlorex process is well suited to the treatment of overhead lubricating stocks from Mid-Continent and Coastal crudes, and overhead and residual stocks from Pennsylvania crudes.

Simplicity—Chlorex extraction is carried out efficiently at, or slightly above, room temperatures. Chlorex is separated by gravity from the condensed open steam used in the recovery distillation. It is unnecessary to dehydrate the stock or the solvent. When Chlorex is agitated with the oil, the raffinate and extract phases separate rapidly. Chlorex has great selectivity and high specific gravity. Chlorex will not polymerize. The solvent may be stored in conventional field tanks at atmospheric pressure without any special precautions to prevent oxidation or evaporation.

Safety—The flash point of Chlorex is [illegible] deg. F. Boiling at 353 deg. F. it is not easily vaporized at atmospheric temperatures and vapor concentrations built up over liquid Chlorex are low. Chlorex has been used commercially in the treatment of lubricating oils for over three years and there has been no case of injury to health or ill effects from its use. Chlorex does not injure the skin and will not cause burns or discoloration.

TRENDS

By H. W. CAMP
Empire Oil & Refining Co.

Despite prices incommensurate with the cost of crude, "hot oil", legislative uncertainty, code violations and other discouraging factors, the past year has seen a number of interesting developments in refinery engineering and operating technique. The changes have not been so pronounced as in some previous years but several items are noteworthy, particularly in the field of lubricating oil manufacture.

Solvent Refining

The use of solvents in the preparation of lubricating oils has gained the widest attention, and a number of large plants have recently been placed in operation. There are seven or eight recognized processes, some using single solvents and others using two solvents simultaneously. Rapid advances in technique are being made and each new plant represents a distinct improvement in design and operating efficiency. Many claims are made for solvent-refined lubricating oils, these including improved viscosity index, carbon residue, and resistance to sludging. Extensive advertising of oils having these qualities will undoubtedly be carried on, and their customer-acceptance will be closely watched by those refiners not at present equipped to compete. It is possible that the industry will find itself engaged in a viscosity index number race similar to the octane number race of recent times.

Propane

For years propane has been anathema to the refiner because of the undesirable properties it imparts to gasoline and expensive depropanizing equipment was necessary for its removal. New developments now make propane valuable in de-asphaltizing lubricating oils, although the volume required is relatively small. In some processes this volatile hydrocarbon is used in connection with another solvent, each serving a different function. The use of propane in conjunction with ordinary sulphuric acid treating is declared practical, and results in oils having improved resistance to sludging. Several plants have been recently completed using propane as a dewaxing medium. Other uses and processes involving this material are being studied.

Low Viscosity Oils

The past few months have witnessed a pronounced trend toward the use of lighter motor oils in automobiles. Motor car manufacturers have inaugurated a campaign on the use of lower viscosity oils for the purpose of improved cold weather starting and reduced internal resistance caused by the use of too heavy oils. The many improvements in the mechanical features of the modern motors make this program feasible as consumption can be held to a nominal figure while using the lighter grade oil. This shift has resulted in a decided improvement in demand for the neutral oils with a corresponding falling off in bright stock requirements. Considerable thought is being given to methods for increasing neutral oil production and to outlets for bright stocks.

Along with the study on low viscosity motor oils, automotive technologists have been analyzing the benefits to be derived from the use of fully refined stocks in transmissions and differentials, and their final adoption will tend to offset volume losses due to the motor oil changes. Work has been carried out on controlled cracking of the heavier stocks for reducing viscosity and on the development of inert and harmless diluents. Solvent refining causes substantial losses in viscosity and probably some stocks will be so treated, not for the purpose of improving quality, but to make lighter oils and eliminate the standard treating and filtering processes.

Solvent extraction of various lubricating stocks has raised difficulties in dewaxing and has developed interest in methods differing from the conventional. These methods employ solvents of various characteristics, one previously mentioned using propane as the dewaxing medium. Recent plants built employ the benzol-acetone solvent mixture with subsequent wax removal by means of a pressure-rotary filter. Another plant just now getting into production employs an organic solvent and removes the wax in centrifuges modified from the present standard type.

Octane Ratings

The past year saw the stabilization of the octane number values of gasoline. With the adoption of the "Q" grade gasoline by the majority of refiners, house brands all over the country now show nearly identical octane numbers. As a matter of fact, there is evidence of some recession in the octane number of non-premium fuels brought about, no doubt, by economic factors. For various reasons a move was started last year for the adoption of a fourth grade of gasoline which would be an unleaded fuel of 65 octane number and would be used primarily for commercial vehicles. The fuel requirements of buses and heavy trucks differ from the requirements of motor cars. There has been a distinct trend toward a more volatile fuel, this increased volatility being gained through additional use of natural and lowering distillation points on refinery production. The use of vapor balancing devices assumes an added importance, not only on refinery storage, but on bulk station tankage as well.

Combination Units

Economic studies have been made in order to determine the optimum balance between skimming, cracking, reforming and leading. The new distillation equipment being installed is of the combined skimming and cracking type. The trend seems to be toward the adoption of large integrated units, these single units having capacity sufficient to handle the entire crude input of the plant.

Gas Polymerization

Considerable interest is being manifested in cracking and polymerizing refinery gases for the recovery of very high octane motor fuel. Small scale runs indicate the recovery of four to eight gallons of one-hundred-plus octane number fuels per 1,000 feet of refinery gas. This operation results in the recovery of some valuable materials from a product now having only fuel value at the best. If the process can be made to operate economically, a wide adoption will undoubtedly follow. The design of suitable equipment will present a nice engineering problem to fabricators because of the special problems involved. As a matter of interest, suppliers of refinery equipment are showing the best of co-operation in furnishing a variety of metals and equipment designed for special and irregular conditions. The past year witnessed the adoption of canned oil by a great many refiners in all sections of the country.

There is a growing list of chemicals used in gasoline and lubricating oils as a result of research on the part of both the oil industry and chemical suppliers. The use of anti-oxidants is rapidly spreading, and it has become the practice in many instances to forego the usual treating, using the anti-oxidant as a stabilizer. The adoption of 10-W and 20-W motor oils has renewed interest in pourpoint suppressors. The refining industry is watching closely the development of compounds to be used in raising viscosity index numbers of motor oils. Interest in extreme pressure materials in gear lubricants, and motor oils as well, is very active at this time.

THE refining industry has been able to maintain its volume of sales through the years of depression better than any other major manufacturing business.

This ability to weather the storm has enabled petroleum refining to gain second rank among the five industries in the U. S. which sell more than a billion dollars worth of goods each year. Based upon annual sales, the report of the department of commerce just released, shows the relative position of these five industries as follows:

Meat Packing	$1,490,085,000
Petroleum Refining	1,378,637,000
Steel Work and Rolling Mills	1,143,889,000
Motor Vehicles	1,096,946,006
Printing	1,004,999,000

In the year just ended, the industry was able to show an improvement over 1933 both with respect to volume of sales and prices and the total revenue will approximate $1,500,000,000. In 1935 there should be a still greater improvement, for this year will more than likely establish a new peak for gasoline consumption in the U. S. and prices should strengthen proportionately.

Of this money received, between $300,000,000 and $400,000,000 represents the value added to the crude oil as the result of manufacturing and is the margin available for the purchase of equipment and supplies and the employment of workers.

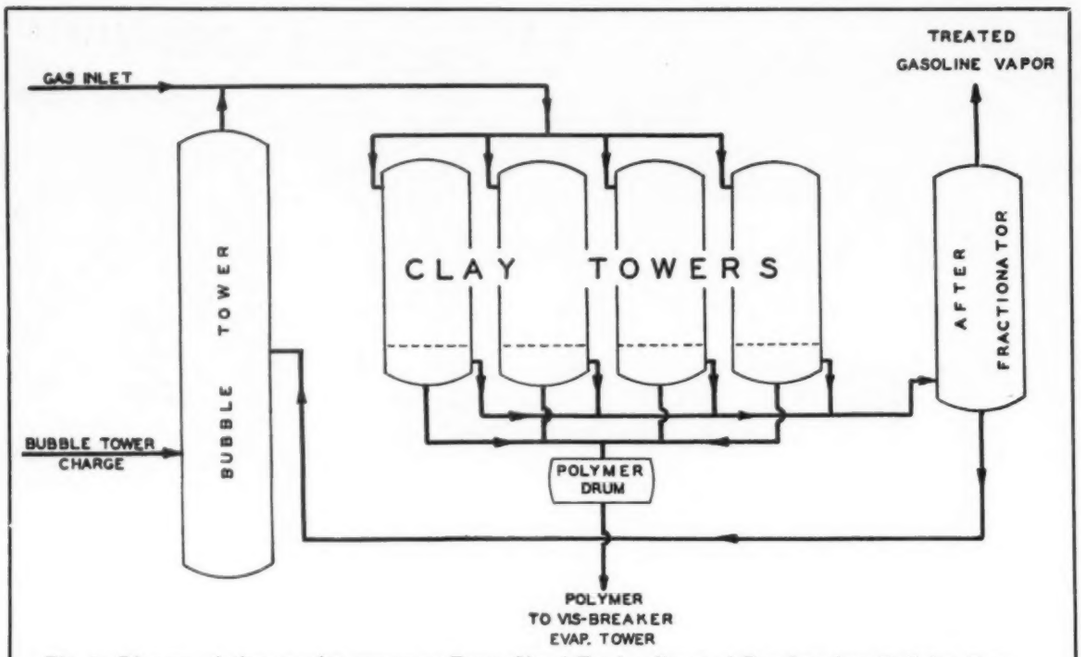


Fig. 1—Diagram of clay treating system at Texas City (Tex.) refinery of Pan American Refining Corp.

Pan American Treats Over Million Barrels Gasoline With Same Earth

By R. H. PRICE* and P. L. BRANDT†
Pan American Refining Corp.

Clay treatment of cracked gasoline vapors has rapidly become one of the most important methods used in the refining of petroleum products. This process was developed by the late T. T. Gray[1] and began to receive commercial acceptance in 1924. Its rapid gain in favor with refiners can be explained by several reasons; among these, clay treating is free from the large losses in both volume and octane number often incurred in acid treating, and is free from the necessity for revaporization of the treated stock before final fractionation. In fact, in some installations no fractionation of the treated gasoline is used after the vapors leave the clay towers. The wide applicability of the clay treating process has been demonstrated by recent experiments showing that it can be used in refining cracked furnace oils as well as gasolines. In a recent paper Steininger[2] has presented a general discussion of clay treating and its development, together with data on the properties of treated gasoline from two single-tower installations. The present article includes a description of the very large Gray process installation on the new combination cracking unit of the Pan American Refining Corp. at Texas City, Tex., and data on the clay treated gasoline produced therefrom.

Description of Installation

The charge to the combination unit, 32,000 bbls. daily of East Texas crude, is topped to remove a straightrun light naphtha, a heavy naphtha, and if desired, a kerosene fraction. After removing light gas oil from the topped crude, the bottoms, together with heavy recycle stock, are cracked in a viscosity breaker coil. The light virgin gas oil and cycle stock of similar boiling range are cracked in a vapor phase cracking coil and the virgin heavy naphtha above mentioned is reformed in another coil. Wet gas from the depropanizing of straightrun light naphtha and from the viscosity-breaker system is compressed and combined with a cracked gasoline of about 420° endpoint from the various cracking coils to make up the charge to the clay towers. The amount of virgin naphtha introduced into the charge by this blending is small—less than 5 per cent of the cracked gasoline.

A cracked furnace oil may be withdrawn continuously from the fractionating system as an ultimate product if desired.

In calculating the clay treating equipment for this unusually large plant, it was recognized by the engineering departments of the Standard Oil Co. (Indiana) and the M. W. Kellogg Co., that jointly designed the installation, that a choice was required between more or larger towers, which would give better results as regards color and induction period, or the minimum investment in apparatus which would be likely to give satisfactory results. The latter course was chosen especially in view of the recognized high anti-oxidant susceptibility of clay treated gasoline. This decision was reached with due regard to the markedly increased cost of large diameter vessels in view of the high operating pressure. As a result the investment per barrel of throughput is undoubtedly lower than on any other Gray process installation.

Four clay towers are manifolded in parallel. (See Figure 1.) Each is 12 feet inside diameter by 19 feet 6 inches height, and contains a false bottom to support the clay charge which consists of about 25 tons of 30-60 mesh clay per tower. During the period covered by the tests tabulated below a single batch of fuller's earth composed of 50 per cent Floridin clay from Quincy, Fla., and 50 per cent fuller's earth from Midland, Fla., was in use. Untreated vapors enter just above the clay bed and the treated vapors are withdrawn below the false bottom. Liquid polymer and some condensed hydrocarbons in the upper gasoline boiling range drain from the clay towers to a common polymer drum, from which they are returned to the fractionating system of the cracking unit wherein heavy polymer is removed as part of the tar and lighter hydrocarbons are recycled through the unit. Treated vapors from the clay towers are cut to the desired endpoint in an after-fractionator, then condensed, and after separating the dry gas the endpoint gasoline is charged to the stabilizer system. Bottoms from the after-fractionator return to the high pressure bubble tower.

The stabilized cracked gasoline is blended with depropanized virgin light naphtha, and this total gasoline is finally sweetened to give a finished product. Most of the inspection data presented below were obtained on the total gasoline in as much as the character of the blend is of greater significance than that of the separate components from an operating standpoint. However, some data are also presented on the cracked gasoline alone.

Temperature Data

Typical temperatures in the clay treating system are as follows:

Bubble tower overhead, 453° F.
Clay tower outlet, 442° F.
After-fractionator overhead, 426° F.

The relationship given between bubble tower overhead and clay tower outlet temperatures is a qualitative one only since this difference is variable, depending first on the amount and temperature of the gas component of the clay tower charge, and second on the age of the clay. With new clay, temperature rises of 12° F. or more through the clay bed have been noted on this installation, while at a clay life of approximately 12,000 bbls. per ton the temperature rise averages 2° F.

Maintenance of high pressure in the clay towers is important for two reasons. In the first place, as pointed out by Steininger[2], the higher the pressure the longer the contact time for a given installation and throughput rate. Furthermore, the higher the pressure at which clay treating is accomplished the less the pressure will have to be raised for the subsequent stabilization operation. Typical pressures on this installation are as follows:

Bubble tower, 195 pounds per square inch.
Clay towers inlet, 194 pounds per square inch.
Clay towers outlet, 191 pounds per square inch.
After fractionator, 190 pounds per square inch.

Experiments have been conducted to determine the increase in pressure drop incurred on cutting out first one and then two of the towers. At the time of this test the pressure drop through four towers in parallel was 8 pounds per square inch, a somewhat higher figure than the average drop shown above. With three towers in parallel the pressure drop increased to 10.5 pounds per square inch, while with two towers in parallel the pressure drop was 17 pounds per square inch. In all three cases the clay tower outlet pressure was 190 pounds per square inch.

Treating Rates

There are at least two distinct methods of expressing treating rates in clay tower installations. The older method expresses the rate as "net barrels of distillate per ton per hour." The newer method, in many respects more informa-

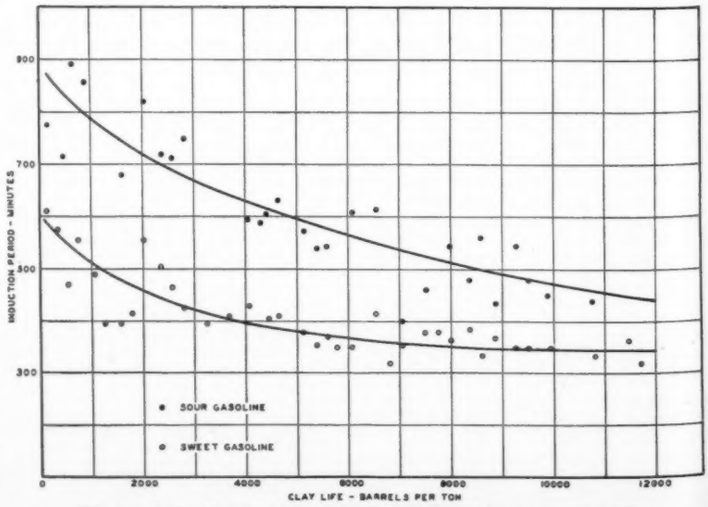


Fig. 2—Induction period of total gasoline (blend) vs. clay life

*Director of research. †Research staff.

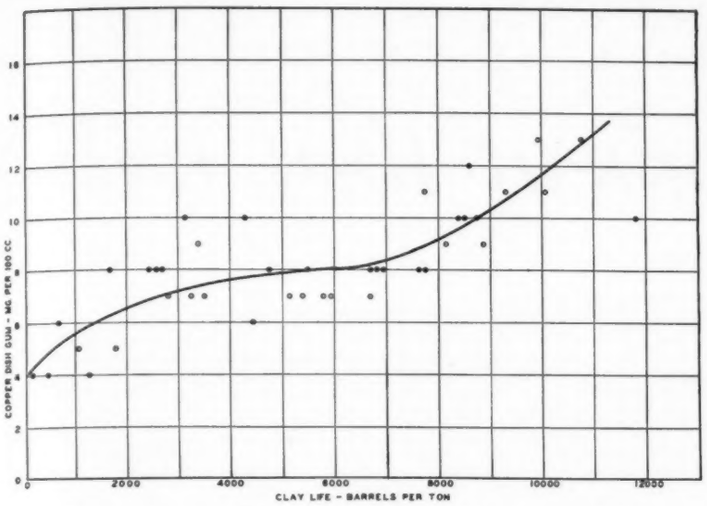


Fig. 3—Copper dish gum of total gasoline (blend) vs. clay life

tive, reports contact time between the vapors and the clay. Typical data for both calculations, supplementing the temperatures and pressures already given, are shown in Table 1.

TABLE 1—SUPPLEMENTAL DATA

Total clay charge, tons	105
Depth of clay bed	14'9½"
Diameter of clay bed	12'0"
Screen size of clay, mesh	30-60
Quantities of products:	
Cracked gasoline, bbl./hr.	582
Polymer, bbl./hr.	29.5
After fractionator bottoms, bbl./hr.	176
Gas, cu. ft./hr. (60° F., 14.7 lbs./sq. in.)	399,580

INSPECTIONS OF PRODUCTS

	Crkd. gaso.	Polymer	After frac. btms.
Gravity, °A.P.I.	60.4	42.9	42.2
I.B.P.	88° F.	140° F.	206° F.
10 per cent	131	266	299
50 per cent	254	350	366
90 per cent	360	584	430
Endpoint	400	656	555

By the older method the treating rate on this installation is 5.54 bbl./ton per hour. In calculating contact time several assumptions are made. First, the free space in the clay bed is assumed to be 60 per cent. Further, it is assumed that 50 per cent of the polymer passes through the clay bed as vapor. Obviously some of the polymer-forming vapors must pass through at least part of the clay bed before polymerization since all of the reaction does not occur at the upper surface of the clay. Any error introduced by this assumption is negligible, however, because of the relatively small amount of polymer. For comparison with certain contact times reported elsewhere the once-through contact time on this installation based on the perfect gas laws is 110 seconds. By applying the known deviations from the perfect gas laws a corrected contact time of 140 seconds is obtained.

As the clay life increases the efficiency of the clay decreases, eventually necessitating change to new clay. It is of interest to compare the characteristics of polymer produced at an early clay life and at a late clay life as shown in the following table:

Clay life (bbl./ton)	2,400	9,800
Inspection of polymer:		
Gravity, °A.P.I.	34.9	42.9
I.B.P., °F.	276	140
10 per cent	326	266
50 per cent	380	350
90 per cent	616	584
Endpoint	...	666
Per cent evap. at 400° F.	63.0	79.5
Polymer, bbl./hr.	24.0	29.5
Polymer, boiling over 400° F., bbl./hr.	8.9	6 0

While the amount of liquid passing to the polymer drum was greater at 9,800 bbl./ton, the amount of the high boiling portion of this material, which is a measure of the actual polymer produced, was appreciably smaller. The larger amount of low boiling hydrocarbons passing to the polymer drum at the higher clay life is to be expected because of the decreased heat effect of clay treating at high clay yields previously mentioned with consequent greater condensation between the bubble tower top and the clay tower outlet.

While there is no general agreement on the subject, most refiners believe that steaming effects a partial revivification of the used clay. At each shut down of the unit the clay in this installation was steamed for 12 hours with 110 pounds steam. The data do not show any marked response to this steaming of the clay, but it is easily possible that the times of steaming were more frequent than necessary and perhaps more prolonged than required. Sufficient data are not yet available to determine the most desirable steaming schedule.

The ultimate life of the clay in any installation depends not only on the conditions of treating, the character of the untreated stock, the clay used, etc., but also on the manufacturing and sales specifications to which the gasoline must conform. Any one of the properties on which data are presented below may prove to be the limiting factor.

Induction Period of Gasoline

The most important property of the treated gasoline as far as gum formation is concerned, is the induction period. Values of this property were obtained on sour and sweet total gasoline (blend) by the Voorhees method throughout the clay life. This method was used essentially as described by Rogers, Bussies and Ward[3], except that shaking of the flasks was omitted and that pressures were measured on a recording gauge of 0-40 pounds per square inch range. It has been found that shaking is unnecessary in this test if a 10-minute correction is applied for the heating-up period instead of the five-minute correction prescribed in the article cited. Table 2 shows average induction periods over 1,000 bbls. per ton periods in the clay life, and Figure 2 shows graphically the data from which Table 2 was compiled. From the sweetened gasoline curve in Figure 2 it will be seen that the initial induction period is quite high, about 600 minutes, and that the slope of the curve, which is steep at first, changes continuously until the induction period reaches a nearly constant value of about 340 to 350 minutes. An anti-oxidant (B.A.P., i.e., monobenzylpara-aminophenol) is used to bring the induction period up to any desired value. The inhibitor response of the sweetened gasoline is very high, averaging 300 minutes per 0.001 per cent B.A.P. Even at clay yields in the neighborhood of 12,000 bbls. per ton only 0.0001 to 0.0002 per cent of the inhibitor is required to bring the gasoline to 400 minutes induction period. It will be seen further from Figure 2 that the difference in induction period between the sour and sweet gasolines varies throughout the clay life, becoming less at higher clay yields.

Copper-Dish Gum

From the sales point of view, copper-dish gum often is an important property of gasoline, although there is an abundance of evidence to show that its interpretation in terms of the ageing behavior of gasoline is quite uncertain. Data on copper-dish gum in sweetened total gasoline (blend) were correlated with clay life and results of these tests are shown in Figure 3 and Table 3, the average in the latter having been compiled from the individual determinations shown in the former. The test was carried out by evaporating 100 cc. samples of the gasoline to be tested in carefully polished hemispherical copper dishes placed on a steam bath.

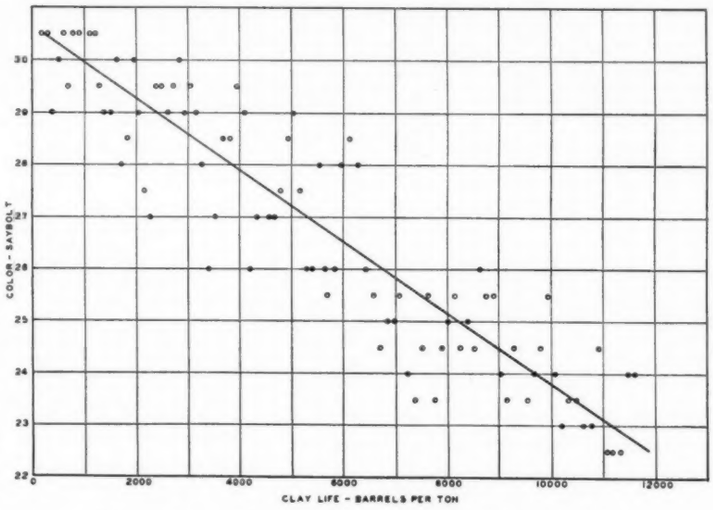


Fig. 4—Color of cracked clay treated gasoline vs. clay life

The gasoline was allowed free access to air during the evaporation. Particularly interesting is the trend to higher copper-dish values after a clay life of approximately 7,000 to 8,000 bbls. per ton. In comparison with these values, a number of actual gum determinations made by Method A[4] showed no preformed gum, within the limit of experimental error, throughout the clay life.

Color of Clay Treated Gasoline

Color and color stability, like copper-dish gum, are important chiefly for sales reasons. Average data on the color of sour cracked gasolines and of sour and sweet total gasoline (blend) are given in Table 4 for 1,000 bbls. per ton periods in the clay life. Color data on the sour cracked gasoline are shown graphically in Figure 4. These data were taken entirely from regular routine laboratory inspections. A more well-defined trend is shown in the colors on the cracked gasoline alone than on the blends in the run-down tanks. Without considering the causes for this discrepancy, it is interesting to note that over the entire period of test the run-down tanks showed a color of 25 Saybolt, or better, and that the drop in color on sweetening averaged only about half a point.

TABLE 2—AVERAGE INDUCTION PERIOD VS. CLAY LIFE

Clay life (bbl./ton)	Total sour gasoline	Total sweet gasoline
0- 1,000	810 min.	553 min.
1,000- 2,000	753	450
2,000- 3,000	727	465
3,000- 4,000	...	403
4,000- 5,000	605	415
5,000- 6,000	553	364
6,000- 7,000	613	362
7,000- 8,000	468	370
8,000- 9,000	492	363
9,000-10,000	508	350
10,000-11,000	440	335
11,000-12,000	395	343

Note—All barrel quantities in this table and throughout this paper are 42-gallon barrels.

TABLE 3—AVERAGE COPPER-DISH GUM VS. CLAY LIFE

Clay life (bbl./ton)	Copper-dish gum Mg./100 cc.
0- 1,000	5
1,000- 2,000	6
2,000- 3,000	8
3,000- 4,000	8
4,000- 5,000	8
5,000- 6,000	7
6,000- 7,000	8
7,000- 8,000	9
8,000- 9,000	10
9,000-10,000	12
10,000-11,000	12
11,000-12,000	..

TABLE 4—AVERAGE COLORS OF GASOLINE VS. CLAY LIFE

Clay life (bbl./ton)	Color, ttl. gaso. Sour	Color, ttl. gaso. Sweet	Color, crkd. gasoline
0- 1,000	28	27	30+
1,000- 2,000	28+	28+	29+
2,000- 3,000	28+	27	29
3,000- 4,000	27+	26	28
4,000- 5,000	28+	27+	27+
5,000- 6,000	28	27+	26+
6,000- 7,000	26	26	26
7,000- 8,000	27	27	24+
8,000- 9,000	26	26+	25
9,000-10,000	26+	26	24+
10,000-11,000	26	26+	23+
11,000-12,000	25	25+	23

Sufficient time has not elapsed to complete long-time ageing tests on dark storage color stability of the gasoline produced during this test period. However, dark storage color stability was followed

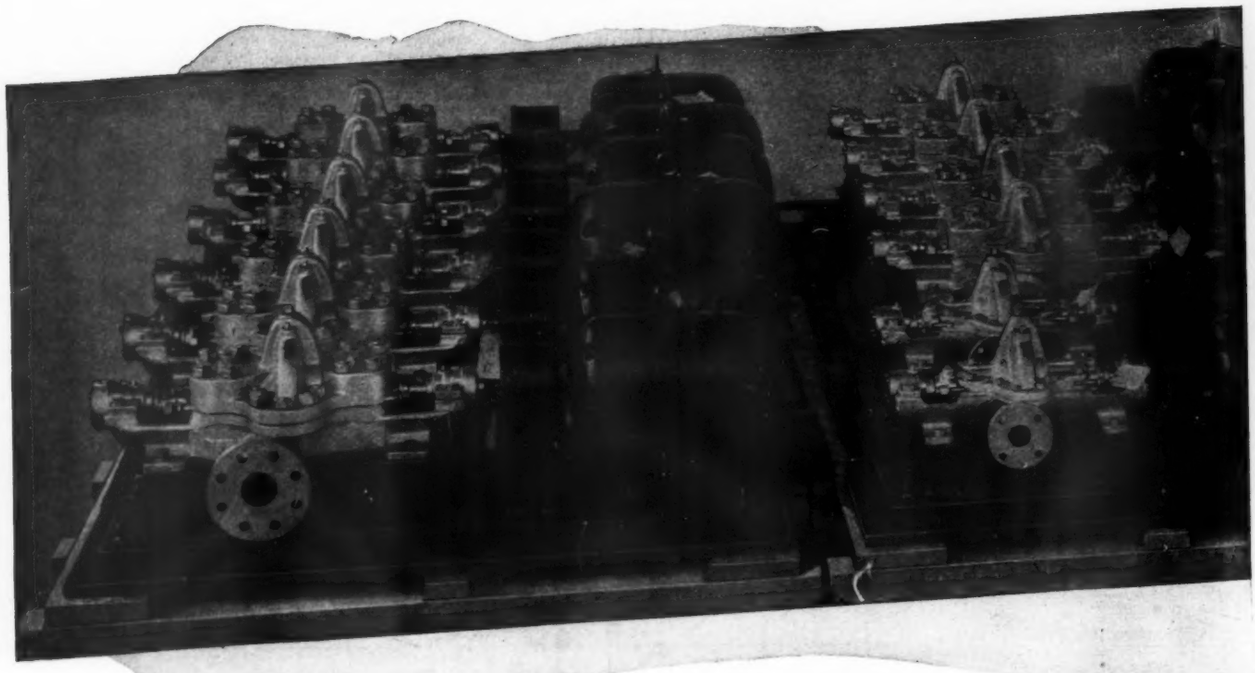
TABLE 5—ACCELERATED DARK STORAGE STABILITY VS. CLAY LIFE

Clay life (bbl./ton)—	Stability—Sweetened gasoline at 212° F. Initial	1 hour	2 hours	3 hours	4 hours	5 hours	6 hours
940	30+	30+	30+	30+	30+	29+	28+
2,140	26	25+	26	24+	23	21+	20+
5,420	26+	26+	26+	26+	26+	24+	23+
5,800	25+	25+	26	25+	25	24	22
7,310	26	26	25+	24+	24+	23	22+
11,310	24+	24	24	23	22+	22	20+

TABLE 6—AVERAGE SUNLIGHT COLOR STABILITIES VS. CLAY LIFE

Clay life (bbl./ton)	Sunlight color stability—Sour gasoline Initial	1 hour	2 hours	3 hours	Sweet gasoline Initial	1 hour	2 hours	3 hours
0- 1,000	26	24	24	22+	27	22	19	17
1,000- 2,000	30+	29+	29	27+	28	25	21	17
2,000- 3,000	27	25+	24+	24+	27	23	21+	19
3,000- 4,000	25+	22	22	21	..	..	..	..
4,000- 5,000	27	25	23+	22+	26	19	19	18
5,000- 6,000	27+	26	25	24	26	24	22	19
6,000- 7,000	25	23	22	22	25	21	19+	18
7,000- 8,000	25	22	20	19	25+	22+	20	18
8,000- 9,000	26	23+	22	20+	25	22+	20+	18
9,000-10,000	25+	23+	21+	20	25	21+	19	18
10,000-11,000	..	..	..	..	..	..	..	..
11,000-12,000	27	26	26	26	25	22	21	20

Another shipment that will



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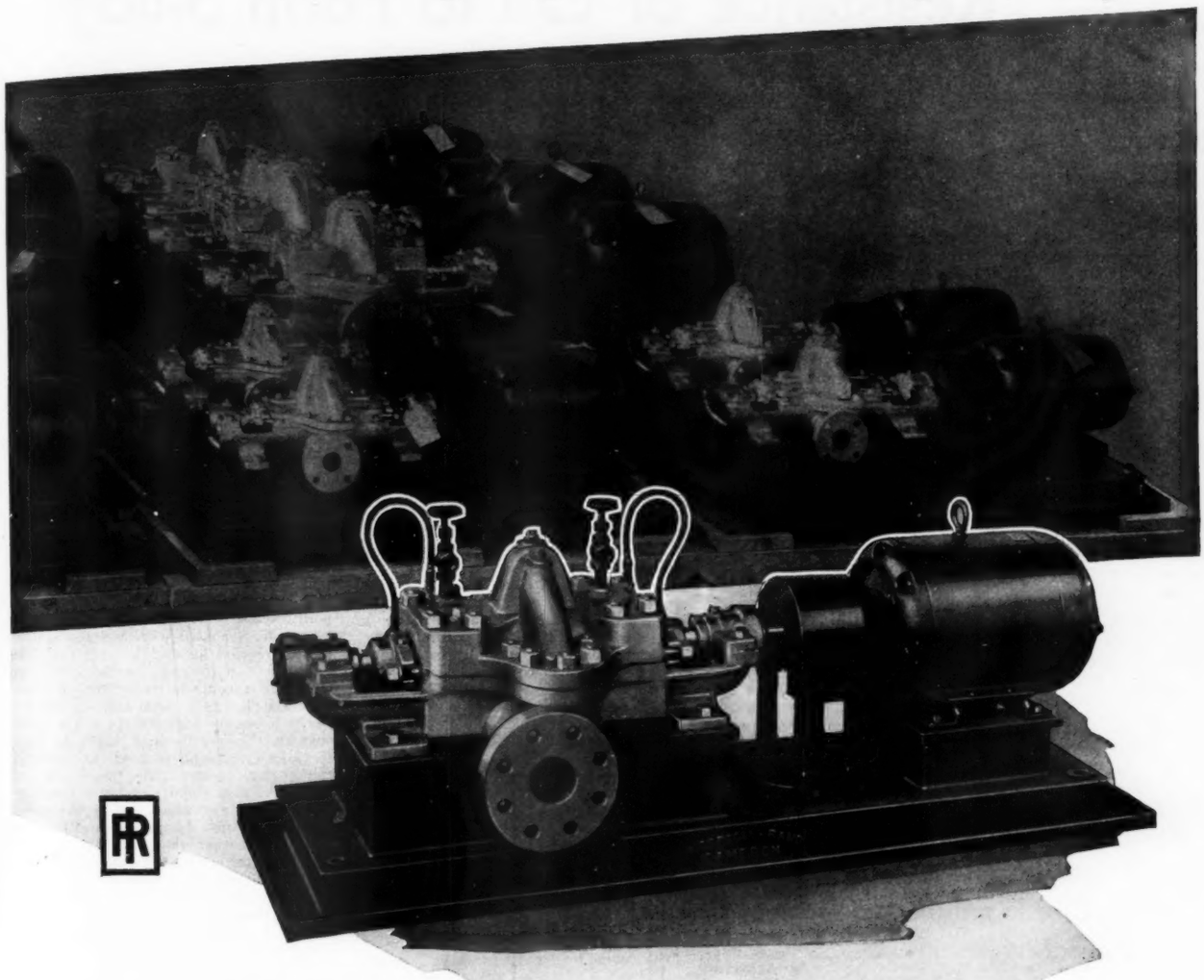

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by an accelerated test‡ developed in the laboratories of the Atlantic Refining Co. and carried out as follows:

Color Stability

Two hundred cc. samples of the gasoline are placed in six 250 cc. Pyrex bottles, the upper third of the outside of each of which is painted black. Each bottle is fitted with a slotted cork stopper and placed in an ice bath to cool the contents to 32° F. The samples are then placed in a boiling water bath so constructed that only the painted portions of the bottles extend above the bath. At one-hour intervals up to six hours single samples of the gasoline are withdrawn, cooled by immediate immersion in an ice bath, and their volumes and colors determined. The colors are corrected for loss by evaporation, assuming that the vaporized material is colorless.

Correlation of Results

Existing data on the correlation of this test with actual storage indicate that one hour of heating under the conditions prescribed is equivalent to two months at atmospheric temperatures prevailing in the southern part of the United States throughout the winter and spring. Table 5 gives data obtained throughout the clay life by means of this test. While little variation is noted in the slope of the color degradation curves obtainable from these data it is apparent that the "effective color stability" or the length of time required to reach a given minimum color decreases throughout the clay life.

Where gasoline is marketed in visible bowls sunlight color stability becomes an important factor. This test was carried out as described by Steininger[2] who reports that one hour exposure to sunlight under the conditions of test is equivalent to eight hours exposure in the visible gasoline bowl. Table 6 presents average sunlight color stability tests on sour and life. These tests were obtained at intervals of two to four days; consequently the average initial colors are not the same as those presented in Table 3, the averages for which were taken from daily reports. It has been found that the sunlight color stability of the clay-treated gasoline is very susceptible to small variations in the amount of sulphur used in sweetening and it seems quite probable that improvement in the sunlight color stability of the sweetened gasoline can be attained by a reduction in the sulphur used.

Summary

Typical clay-treating conditions have been compiled from a study of the operation of the 100-ton, four-tower, clay-treating installation, a part of the 32,000-bbl. combination unit of the Pan American Refining Corp., Texas City, Tex. Properties of more than 1,125,000 bbls. of gasoline treated by one clay charge in this installation have been correlated with clay life. Up to a clay life of 12,000 bbls. per ton (the end of the test period) the total gasoline produced from the unit had an initial color of 25 Saybolt, or better, and a copper-dish gum value of less than 15 mg. per 100 cc. The induction period of the sweetened total gasoline averaged over 400 minutes (Voorhees method) up to a clay life of approximately 4,000 bbls. per ton and at 12,000 bbls. per ton had dropped to an average between 340 and 350 minutes. The B.A.P. response on the total gasoline was very satisfactory, averaging 300 minutes per 0.001 per cent B.A.P.

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[1]Gray, T. T., U. S. Patents 1,340,889 (1920); 1,759,812, 1,759,813, 1,759,814 (1930); 1,908,599 (1933); and others.

[2]Steininger, H. M., Ind. Eng. Chem., 26, 1039 (1934).

[3]Rogers, Bussies and Ward, Ind. Eng. Chem., 25, 397 (1933).

[4]American Society for Testing Materials, Report of Committee D-2 on Petroleum Products and Lubricants and Methods of Test Relating to Petroleum Products, 1932, p. 20.

‡This test method, devised by R. S. Brinkworth, H. V. Hume and E. W. McMullan of the Atlantic Refining Co. research staff, was communicated privately and is reported herewith by permission. Correlation between laboratory and tank storage data using this method is now also being obtained at Texas City.

New Laboratory Unit Measures the Resistance of Oil to Form Sludge

By M. FAIRLIE
Development Department, Sinclair Refining Co.

Investigation showed that lubricating oil oxidation tests in available standard apparatus of various types all had certain weaknesses. Each method of test had one or more of the following failings: Inability to differentiate finely enough between relatively unstable oils; precipitation of tar which makes sampling and analysis questionable; disproportionate severity on light oils; and insufficient severity on very unstable oils. In general, the methods were arbitrary and not directly related to results produced by engines. In many publications there have been criticisms made of laboratory tests in glassware, and in general the attitude taken is that the engine test is the only reliable one and is the final analysis. On this basis it appeared to be very desirable to construct a laboratory test unit which would duplicate as far as reasonably possible all of the fundamental conditions to which oils are exposed in actual engines.

To this end an analysis was made of a typical modern engine. It was found that the atmosphere in the crankcase when the ventilation system was in operation was of substantially atmospheric oxygen content. With the ventilation system inoperative, but with the breather open, the oxygen content averaged 12 per cent, or about 60 per cent that of the atmosphere. A survey of temperatures showed that running crankcase temperatures ranged from 200° F. to 300° F., bearing temperatures up to 400° F., and piston temperatures from 450° F. to 700° F., depending on load. In addition, there is the contact with iron and other metals as possible catalysts.

Construction of Test Unit

The test unit was constructed as shown in Figure 1. The essential parts of the unit are the sump, header with constant level feeding device, aerator, heater, cooler and circulating pump. On the basis that contact with iron was desired, all parts were made from light sheet iron and iron pipe. A Viking pump is used for circulation, fitted with a by-pass, and gives no trouble with leakage or variation in delivery once set. The header is equipped with a regular constant level device which has a specially constructed fine needle valve which is adjusted only from run to run for oils of widely varying viscosity. The heater consists of 40 feet of one-fourth inch pipe wound into a coil 20 inches in diameter and equipped with annular cage type heater elements which may be instantly removed for inspection should trouble arise. The whole is well insulated.

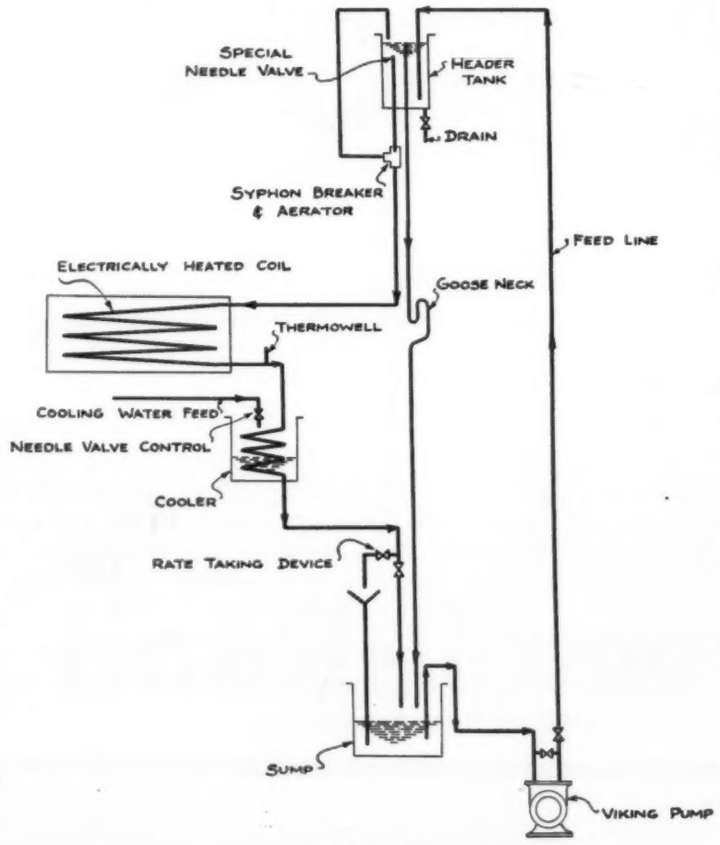

Fig. 1—Arrangement of laboratory test apparatus

Automatic Control

One of the main features of the unit is that it controls itself and requires only the most occasional attention. To start the unit, four liters of oil are measured and weighed into the sump. The pump is then started, adjusting the by-pass to give a small overflow from the header tank. The sump may be gently heated with a burner to aid in bringing the system to equilibrium conditions more rapidly if desired. These conditions are 425° F. heater outlet temperature, 220° F. sump temperature and 300 cc. per minute rate through the heater. The heater current input to the heater, once set, need seldom if ever be adjusted. When the sump temperature reaches 200° F. the auxiliary burner is dispensed with and the system rapidly reaches its equilibrium. One final adjustment of the rate may be necessary. Once set it controls itself; for example, should a change in room temperature occur to lower the temperature in the sump slightly, this results in a slight increase in viscosity causing reduced rate through the heater, greater time factor therein, and consequent slightly higher heater outlet temperature, which raises the sump temperature to its proper equilibrium. This means that the unit will run almost indefinitely with a temperature variation not exceeding ±1° F. The cooler is only required when room temperature exceeds about 80° F. in summer. Water is fed as required and is allowed to boil continuously, the feed being just enough to replace evaporation. The cooler is equipped with a reflux condenser and level gauge not shown in the diagram, to keep conditions constant, and the entire system equilibrium is controlled by the water level. In testing very unstable oils suffering rapid viscosity rise, it is occasionally necessary to adjust the needle valve controlling oil rate during a run. The aerator and syphon breaker governs air admission, which remains constant with the oil rate, and results in a coarse foam of oil and air being fed through the heater.

Duration of Test

An oil is normally run for 150 hours in this unit, samples being taken at 50, 100, 125 and 150 hours for tar and viscosity determination, the oil from the latter test being returned to the unit. At 150 hours the test is ended except in the case of very stable oils which are run to the end of their induction period (1 per cent tar, see below). The oil is weighed out to get a measure of loss by volatility, the retention being known, and full tests obtained on the oil. In running the analysis for tar on these oils, a method is employed which gives somewhat more reliable results than the usual method, which employs a Gooch crucible. Our method is to employ a fine Alundum crucible of Sargent RA 84 grade, which gives higher retention than a Gooch, and at the same time a faster filtering rate and fewer samples which are unfilterable. The naph-

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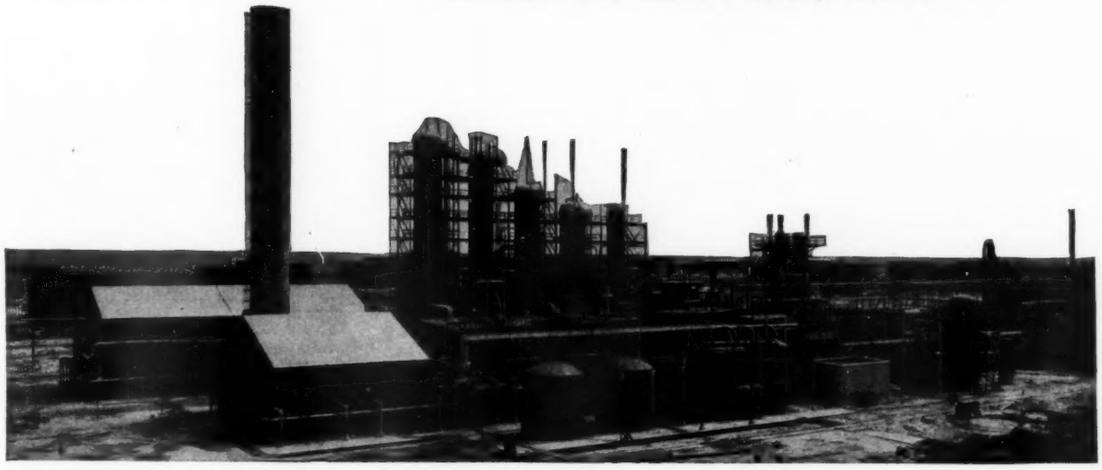

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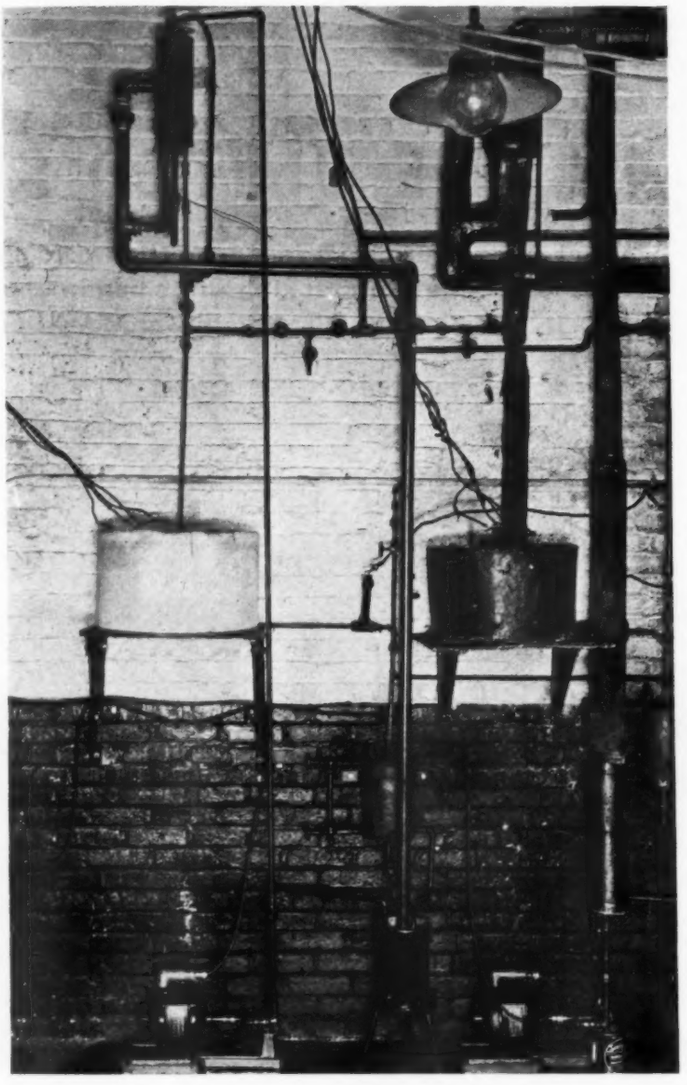
To correlate results from this unit with service results, tests were run in 17 cars under "city driving" and highway conditions, over a period of two years for a total test mileage of 201,900 miles. Reasonably good consistency in results was shown when the important variables such as mileage, mileage per day, per cent replenishment, presence or absence of a filter were allowed for. It was found that the characteristics of the oxidized oils, particularly the percentage tar, compared closely with the used oils from cars, 75 hours in the laboratory unit being approximately equivalent to 1,000 miles of city driving in the average car. Under city driving conditions, potential viscosity rise is usually balanced by dilution, but the viscosity rise in the test unit is equivalent to the dilution-free viscosity of the used crankcase oil. It is also indicative of viscosity rise on highway driving where dilution is at a minimum.

Laboratory Versus Service Tests

As a further step in aiding correlation with service conditions, a series of laboratory engine tests were made to determine the ultimate safe useful life of motor oils. These tests showed that under mild conditions of 180° F. jacket temperature, an oil may be used containing up to 5 per cent tar before serious ring sticking occurs. As jacket temperature rises, the sensitivity to tar content increases rapidly. At 212° F. jacket temperature, an oil containing 1 per cent will begin to cause sticking rings, while at 250° F. jacket temperature an oil containing 0.5 per cent tar will do the same. In that 212° F. is the maximum jacket temperature likely to be met with in the majority of service, and also because tests showed that gasoline consumption begins to show a consistent increase once the 1 per cent tar mark is passed and subsequent tar formation in the oil becomes very rapid, this point was selected as that at which an oil may be considered to have reached the end of its safe useful life for hard service. The useful life of an oil may, therefore, be reasonably closely estimated from the number of hours required to build up this amount of tar in the laboratory unit, on the basis of 75 hours pere 1,000 miles.

Almost all characteristics of a typical used oil are shown by the oil from this laboratory unit, such as tar, viscosity, Conradson carbon and acidity. The color is not as dark as a crankcase oil, because of the absence of blowby carbon, and also, dilution is not present. Also, there are no deposits of tarry matter such as the black liver-like emulsified deposits which occur in cool running engines. The latter is not an objection, in that tar formation is essential to the formation of the liver-like emulsified deposit, and in addition, deposits are undesirable because once deposited they are no longer represented in an analysis of the oil. The occurrence of deposits is prevented by the rapid circulation of the oil and aids in more accurately estimating the sludging potentialities of an oil.



Apparatus for testing motor oils under service conditions of temperature and oxidation

Results of Tests

In attempting to correlate results from this test with road tests made at continuous high speed on the road, discrepancies immediately appeared. It was found that in road tests at a continuous speed of 60 miles per hour, each S.A.E. grade selected its own equilibrium crankcase temperature, the heavy oils operating at much higher temperature than light oils. From S.A.E. 20 to S.A.E. 50, inclusive, the temperature differentials were uniform, and of sufficient magnitude that these four oils all gave the same operating viscosity and rates of consumption. The light oils, therefore, developed much less tar than the laboratory tests indicated in relation to the heavy oils, apparently because of their lower operating temperatures. When calculations were made for the difference in average operating temperatures of the various grades, and related to the relative rates of tar formation found in the laboratory under constant temperature tests, the results checked exactly.

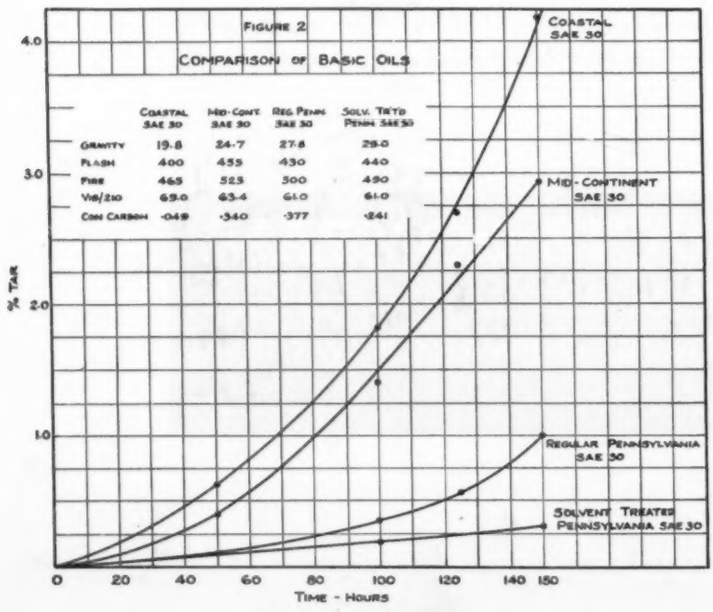
City Driving Conditions

Under city driving conditions these temperature differentials do not exist, and such test results follow laboratory indications directly. Figure 2 shows test results on Coastal, Mid-Continent, regular Pennsylvania and solvent treated Pennsylvania S.A.E. 30 oils. The induction periods of these oils are 68, 81, 150 and about 300 hours, respectively. The latter is only shown to 150 hours on the curve.

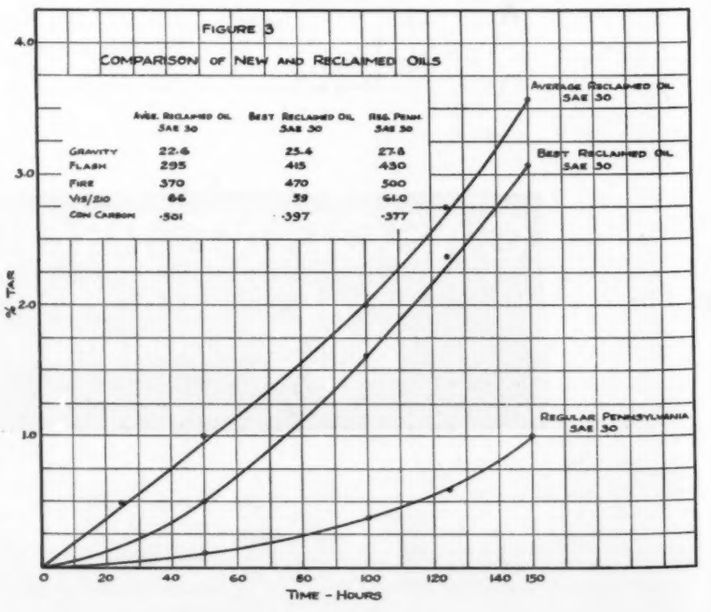
Figure 3 shows a comparison of a relatively very good reclaimed oil made commercially from a composite New York City used oil, probably containing some Pennsylvania oil; an average reclaimed oil (one of 50 samples collected in the Mid-Continent area from commercial reclaimers); and a fresh Pennsylvania oil. The very short induction period of the average reclaimed oil will be noted.

Can Duplicate Results

This laboratory test unit will duplicate its own tests very closely, and is capable of picking out fine differences in slightly different methods of treating oils. It appears to be free from the weaknesses of other test apparatus, in that it can differentiate finely between unstable oils, and gives a more accurate picture of the value of light oils. Extremely stable oils can be compared without interference by disproportionately high viscosity rise. In as much as it duplicates engine temperatures, atmosphere and metal contact characteristics, as well as producing tar and viscosity changes and ratios which have been shown to represent critical values for hard engine service, it has been adopted by this laboratory as a tool for calibrating the stability of lubricating oils.



	Coastal SAE 30	Mid-Cont. SAE 30	Reg. Penn. SAE 30	Solv. Treated Penn. SAE 30
Gravity	19.8	24.7	27.8	28.0
Flash	400	455	430	440
Fire	465	525	500	490
Vis/210	69.0	63.4	61.0	61.0
Con Carbon	.049	.340	.377	.241



	Aver. Reclaimed Oil SAE 30	Best Reclaimed Oil SAE 30	Reg. Penn. SAE 30
Gravity	22.6	25.4	27.8
Flash	295	415	430
Fire	370	470	500
Vis/210	66	59	61.0
Con Carbon	.501	.397	.377

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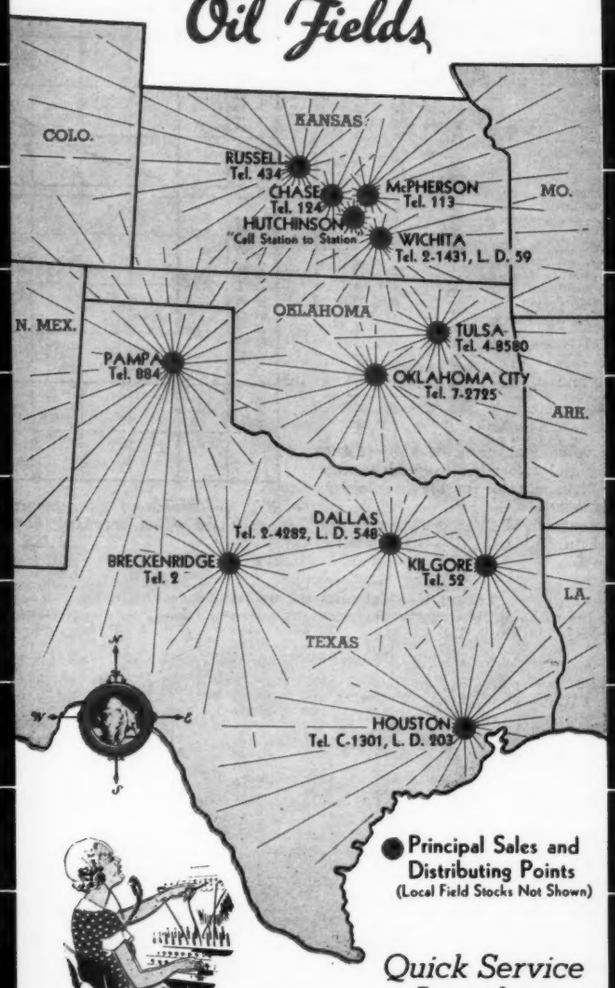

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Survey of Michigan Crude Analyses Shows Necessity for Cracking

By GUSTAV EGLOFF and EDWIN F. NELSON
Universal Oil Products Co.

Oil has been known in Michigan since 1865 when it was discovered while drilling for salt water. Up to 1926 sporadic drilling had been taking place into glacial drifts up to 1,000 feet which covers the southern peninsula, hence a knowledge of subsurface conditions comes from well records. Within the past 10 years an intensive drilling campaign has taken place in many counties with discoveries of commercial production of crude oils, which rose from 103,000 bbls. for the year 1926 to 10,566,000 bbls. in the year 1934, making Michigan the second largest oil state east of the Mississippi. The producing wells of the State at the end of 1934 were 1,070.

The number of wells drilled and their production for the year 1934 are shown in Table 1.

TABLE 1—MICHIGAN CRUDE OIL FIELDS
Summary by Counties, 1934

County—	Comp	Prod.	Dry	Gas
Midland	220	196,407	19	0
Isabella	93	5,250	24	33
Ogemaw	31	2,737	8	6
Oceana	15	696	6	0
Montcalm	16	756	7	6
Muskegon	5	60	1	2
Saginaw	10	15	8	0
Lapeer	8	57	4	0
Shiawassee	2	0	2	0
St. Clair	3	0	3	0
Allegan	1	0	1	0
Monroe	1	0	1	0
Mecosta	19	0	8	11
Osceola	4	0	4	0
Orenac	3	0	3	0
Gratiot	5	0	4	1
Clare	2	0	2	0
Oakland	1	0	1	0
Bay	1	0	1	0
Wayne	1	0	1	0
Total 1934	441	205,978	108	59
Total 1933	296	150,086	67	11
Difference	145	55,892	41	48

Analyses of Crude

Many of the crude oils found in Michigan have been analyzed particularly for their gasoline content and octane rating and the results of these laboratory tests are reported here. The gasolines produced from these crudes are low in octane value and must be subjected to cracking and reforming to produce antiknock fuels suitable to operate modern automobiles.

The analyses of these crudes are summarized in Table 2, the characteristics

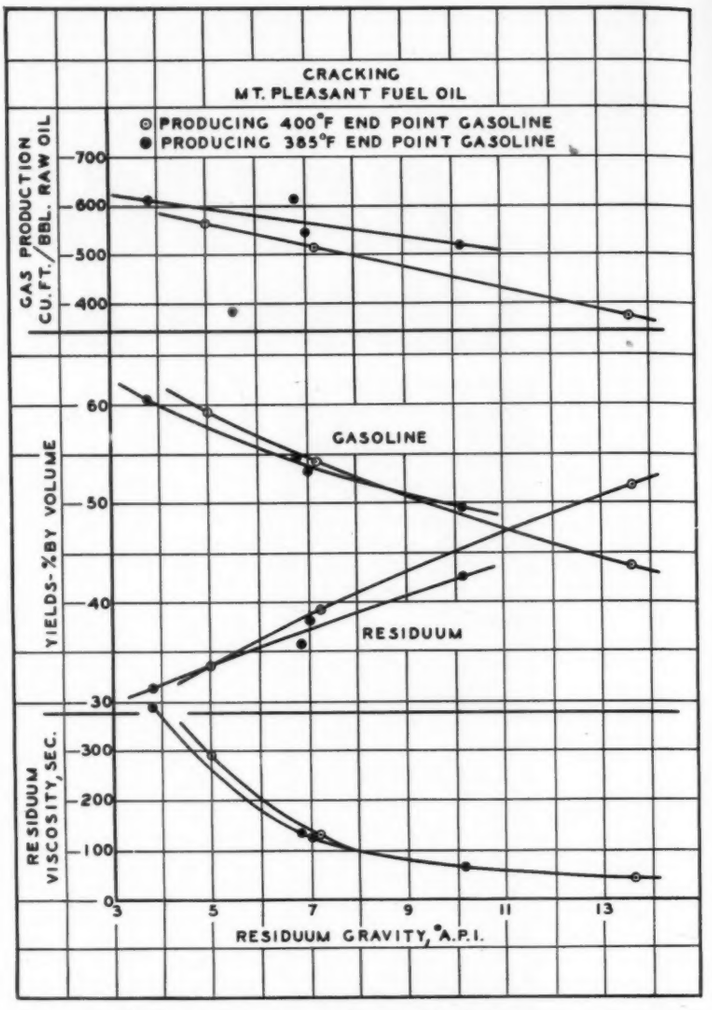

Fig. 1—Yields of gas, gasoline, residuum and the quality of the residuum produced when cracking Mount Pleasant fuel oil to produce gasolines of 385 and 400° F. endpoints

TABLE 2—ANALYSES OF MICHIGAN CRUDE OILS

Crude—	Muskegon	Muskegon	Saginaw	Traverse	La Pere	Monroe	Shiawassee	Oceana	Vernon	Greendale	Leaton	Chippewa	Porter	Ogemaw	Gladwin	Edmore
A.P.I.° gravity	38.4	38.5	42.2	36 9	35.1	37.6	44.5	37.5	43.3	41.1	43.2	41.8	41.8	36.9	42.3	42.2
Sulphur, per cent	0.82	0.94	0.28	0.61	....	0.35	0.13	0 40	0 28	0.15	0.17	0.13	0.18	0.29	0.18	0.12
Initial boiling point, °F.	147	130	146	139	194	180	114	111	122	118	109	134	114	107	104	129
Per cent distilled over.																
5 per cent	227	188	198	197	260	...	...	164	183	187	170	201	186	168	280	188
10 per cent	272	240	222	243	344	289	190	212	219	231	213	239	229	211	219	217
20 per cent	354	315	267	308	377	364	246	295	287	305	286	313	305	291	291	267
30 per cent	412	390	311	378	459	455	300	379	354	379	357	375	379	386	360	324
40 per cent	457	450	363	454	523	521	368	470	418	441	426	441	444	480	432	383
50 per cent	508	518	426	532	575	609	450	557	492	508	495	510	509	576	499	453
60 per cent	565	600	494	617	632	*420	530	653	562	572	565	572	576	668	564	529
70 per cent	652	660	566	688	677	†428	‡572	711	649	662	654	667	665	708	650	613
80 per cent	696	698	648	718	704	‡437	...	731	707	717	711	726	713	727	706	699
90 per cent	717	718	694	737	721	§572	...	741	739	733	731	747	730	741	725	738
Endpoint	733	725	700	742	760	...	...	752	754	749	757	762	754	752	742	751
Per cent distilled over	97.5	97.5	98.0	97.0	98.0	....	....	96.5	98.0	97.5	97.5	97.5	97.0	96.0	96.0	98.0
At 400° F.	28.0	32.0	46.5	33.0	23.0	....	....	32 0	37.0	33 5	36.0	34.0	33.5	31.5	35.5	43.0
At 410° F.	29.5	34.0	47.5	34.5	....	....	....	33.0	38.5	35.0	37.5	35.5	35.0	33.0	37.0	44.5
At 437° F.	35.0	38.0	51.0	38.0	....	....	....	36.5	42.5	39.5	42.0	39.5	39 0	35.5	41 0	48.0
At 572° F.	61.0	57.0	71.5	55.0	....	....	....	51.5	61.5	60.0	61.0	60.0	59.5	49.5	61.0	65.5
Coke, per cent by weight	2.2	2 6	2.0	2.4	1.9	....	....	2.4	1.4	1.7	1 6	1.9	2.2	2.7	2.4	1.6

*26 per cent. †27.5 per cent at. ‡28.5 per cent at. §47 per cent at. ¶64 per cent at.

TABLE 3—ENGLER DISTILLATION OF TOPPED CRUDES

Crude—	Muskegon	Muskegon	Saginaw	Traverse	La Pere	Oceana	Vernon	Greendale	Leaton	Chippewa	Porter	Ogemaw	Gladwin	Edmore
A.P.I.° gravity	30.9	29.2	31.2	27.7	29.4	27.6	32.5	31.2	31.9	31.6	30.7	25.8	30.8	31.7
Sulphur, per cent	0.91	1.15	0.40	0.78	....	0.54	0.38	0.20	0.22	0.21	0 26	0.43	0 28	0.18
B. S. & W.	0.2	0 1	Trace	Trace	0.3	0.2	None	Trace	Trace	Trace	None	0.4	0 4	0.1
Cold test	Below zero	Zero	5° above	Below zero	5° F.	70° F.	Below zero	Below zero	Below zero	Below zero	Below zero	Below zero	30° F.	50° F.
Universal vis. sec. at 100° F.	61	73	57	102	87	122	63	64	64	63	65	165	69	61
Furol in sec. at 77° F.	14	17	14	20	18	25	14	14	9	13.5	14	33	15	14
Initial boiling point, °F.	423	424	426	441	451	442	437	435	426	431	434	439	435	444
Per cent distilled over:														
5 per cent	444	452	456	469	477	478	459	461	468	454	462	473	463	469
10 per cent	459	468	468	484	492	501	478	477	483	470	478	497	480	483
20 per cent	484	495	494	517	526	540	502	507	510	500	509	543	509	511
30 per cent	518	536	518	562	568	590	538	538	548	533	540	597	542	545
40 per cent	557	590	550	613	605	650	574	581	588	572	579	642	583	586
50 per cent	605	644	584	670	642	697	627	637	644	627	638	672	641	631
60 per cent	666	700	630	699	671	720	670	693	696	682	682	691	691	678
70 per cent	695	722	670	715	700	734	700	714	728	707	724	699	711	710
80 per cent	707	742	702	727	713	745	720	731	748	720	732	710	717	731
90 per cent	716	760	730	739	726	758	734	747	760	730	...	723	727	742
Endpoint	739	760	768	755	752	758	744	762	760	751	746	748	751	759
Per cent distilled over	96.5	97.0	97.0	98 5	97.5	96.5	97.5	97.0	97.5	97.5	97.0	95.5	97.0	98.0
At 437° F.	3.5	1.5	1.5	....	....	....	....	....	Trace	1.0	Trace	....	Trace	....
At 572° F.	43.5	36.0	46.0	32.0	31.5	27.0	39.5	38.0	36.0	40.0	38.0	25.5	37.5	36.5
Per cent coke by weight	3.6	3.1	2.9	3.6	2.7	3.6	2.6	2.9	2.5	2.7	3.1	4.3	2.9	1.9

of the topped crudes[1] are shown in Table 3 and the tests on the straightrun gasolines recovered from the various crudes are included in Table 4.

Mount Pleasant Crude Oil

Mount Pleasant crude oil is a highly paraffinic one and particularly of the straight chain type as reflected by the very low octane value of 22 for a 400° F. endpoint gasoline.

An analysis off Mount Pleasant crude is shown below:

MOUNT PLEASANT CRUDE

Gravity, °A.P.I.	40.7
	°F.
I.B.P.	112
Per cent distilled over:	
5 per cent	183
10 per cent	231
20 per cent	305
30 per cent	381
40 per cent	445
50 per cent	510
60 per cent	583
70 per cent	668
80 per cent	727
90 per cent	745
Endpoint	753
Per cent over	97.5
Per cent coke by weight	2.1

The crude oil was fractionated into four gasoline cuts to determine the percentage and endpoint of fractions with various antiknock ratings. The results shown in Table 6 illustrate the low antiknock quality even in the light fractions.

TABLE 6—ANTIKNOCK VALUES

Gasoline E.P., °F.	275	325	400
Per cent of crude	15.9	23.5	35.9
Octane No. M.M.	51	40	22
Gravity, °A.P.I.	74.2	68.9	62.5
	°F.	°F.	°F.
I.B.P.	91	99	107
Per cent distilled over:			
5 per cent	117	131	142
10 per cent	127	146	162
20 per cent	142	167	193
50 per cent	179	216	269
90 per cent	229	281	364
Endpoint	273	324	401
Per cent distilled over	98.0	98.0	98.5
Per cent bottoms	1.0	1.0	1.0
Per cent loss	1.0	1.0	0.5

Reforming Operation

In order to raise the octane number of the 400° endpoint straightrun gasoline, it was subjected to a reforming or cracking operation on a once through basis at elevated temperatures.

The straightrun gasoline analyzed by the A.S.T.M. 100 cc. method and by the C.F.R. motor method for octane rating gave results as shown in Table 7.

The cracked residue produced from the above cracking operations of the straightrun gasoline were analyzed with results as shown in Table 8.

A fuel oil representing 41 per cent of a Mount Pleasant crude was cracked into high octane gasoline. The fuel oil was analyzed and showed the properties in Table 9.

The fuel oil was subjected to cracking conditions to produce high yields and octane rating motor fuels. Three runs were made to produce 400 endpoint gasoline with the simultaneous production of a cracked residuum having varying viscosities. Three further runs were made producing 385 endpoint gasoline in order to study the effect of lowering the endpoint on the octane value of the gasoline produced. Likewise during these three runs various grades of cracked residuums were produced. The results of these six runs are shown in Table 10.

Figure 1 illustrates the yield of gas, gasoline, residuum and quality of the residuum produced when operating to make 385° F. and 400° F. endpoint gasoline.

[1] A number of crude oils were obtained through the courtesy of Dr. Cary Wagner, Pure Oil Co.

Additional Analyses

Analyses of the Michigan crude oils shown in Table 5 were obtained through the courtesy of Prof. George Granger Brown of the University of Michigan.

TABLE 5—MICHIGAN CRUDE OIL ANALYSIS

Crude—	Oceana	Vernon	Greendale	Leaton	Chippewa	Porter	Ogemaw	Buckeye pipe line
Gravity, °A.P.I.	37.2	41.9	40.9	43.0	41.3	42.0	36.8	37.1
Sulphur, per cent	0.32	0.22	0.18	0.16	0.21	0.18	0.20	0.26
Color	Black	Green	Black	Black	Black	Dark green	Black	Black
Asphalt—Conradson carbon x 2.5	4.2	2.1	3.2	2.7	2.9	3.9	5.2	3 8
Distillation Yields, Per Cent by Volume								
Gasoline, cut initial to 325° F.	22	26	23	24.5	23	23	23	22.5
Naphtha, 325° to 400° F.	8	11.5	10	10	10	8.5	8	8.5
Kerosene, 400° to 600° F.	21	24	26.5	25	26.5	27	19	22.5
Gas oil, 600° to 750° F.	14	14	13	13	13.5	12.5	14	14
Lubricating dist., 750° to 900° F.	13	9.5	11	10	10.5	10	12	11
Residuum	18.5	12.5	14	13	13	13	20	19.5
Distillation loss	3.2	2.4	2.1	4.5	2.6	5.2	4.9	1.6
Tests on Untreated Products								
Gasoline:								
Gravity, °A.P.I.	64.7	65.9	65.8	66.4	66.1	68.3	62.5	63.4
Color	....	....	....	....	....	21	19	25
Sulphur	....	....	....	....	....	.030	.023	.020
Doctor	Sour	Sour	Sour	Sour	Sour	Sour	Sour	Sour
Distillation, A.S.T.M.:								
Initial, °F.	119	114	132	132	118	110	128	118
50 per cent	212	229	234	230	232	224	225	235
Endpoint	333	318	326	328	324	326	321	319
Octane No. (A.S.T.M.-C.F.R. D 357-33T)	55	36	33	36	35	36	59	51
Naphtha:								
Gravity, °A.P.I.	....	....	....	....	....	53	46.6	48.3
Color, Saybolt	....	....	....	....	....	21	20	22
Sulphur	....	....	....	....	....	.048	.038	.031
Doctor	....	....	....	....	....	Sour	Sour	Sour
Distillation, A.S.T.M.:								
Initial, °F.	....	....	....	....	....	310	318	315
50 per cent	....	....	....	....	....	356	356	354
Endpoint	....	....	....	....	....	412	406	398
Kerosene:								
Gravity, °A.P.I.	....	....	....	....	....	43.0	37.9	38.7
Color, Saybolt	....	....	....	....	....	12	Yellow	12
Sulphur, per cent	....	....	....	....	....	.092	.121	.094
Doctor	....	....	....	....	....	Sour	Sour	Sour
Distillation, A.S.T.M.:								
Initial, °F.	....	....	....	....	....	416	....	*420
50 per cent	....	....	....	....	....	487	....	465
Endpoint	....	....	....	....	....	562	....	528
Lubricating Oil								
Distillate:								
Gravity, °A.P.I.	....	27.0	....	....	....	25.0	24.1	27.0
Color	This cut from all crudes darkens upon standing							
Viscosity, 130° F.	....	108	....	....	....	145	173	114
Viscosity, 210° F.	....	47	....	....	....	52	53	49
Vis. index	....	100	....	....	....	95	59	116
Residuum:								
Gravity	14.5	18.5	16.4	17.9	16.8	15.6	14.2	18.4
Color	Black	Green	Black	Black	Black	Black	Black	Black
Carbon residue	9.1	6.7	9.2	8.4	8.8	12.0	10.4	7.8

*Kerosene is cut at 400-550° F.

KEROSENES

	Porter		Ogemaw		Buckeye P. L.	
	400-600° F.	400-550° F.	400-600° F.	400-550° F.	400-600° F.	400-550° F.
Sulphur, per cent	.041	.051	....	.044	....	.043
Acid and caustic treated sample +.9 per cent solution calcium hypochlorite solution, volume per cent	Unsatisfactory		Unsatisfactory		....	5
Sulphur, per cent	....	....	....	....	....	.048

TREATING TESTS

Minimum amounts of chemicals for treating distillates to produce finished products which are sweet to doctor test and which have sulphur per cent beow 0.1 and which have Saybolt colors better than +21.

GASOLINES

(325° F. cut temperature)

Crude—	Porter	Ogemaw	Buckeye Pipeline
Sulphuric acid (66° Be.) lbs./bbl.	5 Sour	1.5 Sour	2.5 Sour
Calcium hypochlorite volume per cent of .9 per cent solution	10 Sour	7	7
Calcium hypochlorite—same solution preceded by a wash with 5 per cent by volume of a 10 per cent caustic soda solution	10	2.5	2 5
Sulphur, per cent after treatment	.030	.012	.029
Sodium plumbite—10 per cent caustic soda solution saturated with PbO per cent volume on gasoline.	4	1	1
Sulphur, per cent after treatment	.029	013	.021
Sodium plumbite—same solution preceded by a wash with 5 per cent by volume of a 10 per cent caustic soda solution	2	1	1
Sulphur, per cent after treatment	.033	....	....

Hart Crude Oil

The Hart Field in Oceana County was discovered in the year 1932 and is a superior Michigan crude in regard to octane rating of its straightrun gasoline

(Continued on Next Page)

TABLE 9—PROPERTIES OF MOUNT PLEASANT TOPPED CRUDE

Gravity, °A.P.I.	23.8
Specific gravity @ 60° F.	0.9111
Flash (Cleveland Open Cup), °F.	305
Fire (Cleveland Open Cup), °F.	355
Flash (Pensky-Martens), °F.	235
Vis., Univ. @ 100° F., secs.	275
Vis., Furol @ 77° F., secs.	66
Sulphur, per cent	0.36
Cold test, °F.	55
B. S. & W., per cent	0.3
100 cc. Distillation	
I.B.P., °F.	480
Per cent distilled over:	°F.
5 per cent	536
10 per cent	583
20 per cent	656
30 per cent	692
40 per cent	712
50 per cent	723
60 per cent	730
70 per cent	735
80 per cent	743
90 per cent	752
Endpoint	760
Per cent over	96.0
Per cent coke by weight	4.0
Per cent @ 572° F.	8.5

TABLE 11—ANALYSES AND YIELDS OF STRAIGHTRUN GASOLINE FROM HART CRUDE

Gasoline, endpoint, °F.	325	400
Yields, per cent by volume:		
Gasoline	21.3	32.4
Fuel oil residue	78.5	67.3
Loss	0.2	0.3
Analyses of Products		
Gasoline:		
Gravity, °A.P.I.	64.3	58.8
Oct. No. (motor method)	57	44
100 cc. A.S.T.M. Distillation		
	°F.	°F.
I.B.P.	118	126
Per cent distilled over:		
5 per cent	140	154
10 per cent	154	170
20 per cent	174	199
50 per cent	212	264
90 per cent	270	352
Endpoint	325	399
Per cent over	98.5	98.5
Per cent bottoms	1.2	1.2
Per cent loss	0.3	0.3
Fuel oil residues:		
Gravity, °A.P.I.	30.0	26.3
Flash (C. O. C.) °F.	....	275
Fire (C. O. C.), °F.	....	285
Flash (Pen.-Mart.), °F.	....	245
B. S. & W., per cent	....	0.2
Cold test, °F.	....	75
Vis., Furol at 122° F.	....	14
100 cc. Engler Distillation		
		°F.
I.B.P.		448
Per cent distilled over:		
5 per cent		480
10 per cent		502
20 per cent		546
50 per cent		689
Endpoint		724
Per cent over		95 0
Per cent coke by weight		5.3
Per cent at 572° F.		24.0

TABLE 4—A.S.T.M. 100 cc. DISTILLATION OF STRAIGHTRUN GASOLINES

Crude—	Muskegon	Muskegon	Saginaw	Traverse	La Pere	Oceana	Vernon	Leaton	Chippewa	Porter	Ogemaw	Gladwin	Edmore
A.P.I.° gravity	61.2	61.1	57.5	59.0	56.1	61.1	63.2	63.2	63 5	63.7	61.7	63.4	58.2
Sulphur, per cent	0 13	0.13	0.09	0.05	....	0 06	0.07	0.04	0.02	0.025	0.024	0.03	0.02
Doctor test	Pos.	Pos.	Pos.	Pos.	....	Pos.	Pos.	Slightly sour	Pos.	Pos.	Pos.	Pos.	Slightly sour
Initial boiling point, °F.	112	110	137	122	164	99	118	114	109	122	99	104	131
Per cent distilled over:													
5 per cent	154	148	178	165	211	134	134	139	149	149	131	141	169
10 per cent	177	174	196	182	226	147	148	174	168	164	149	162	185
20 per cent	211	205	220	206	246	178	178	188	199	188	177	193	208
30 per cent	238	231	236	226	...	205	200	217	223	214	202	218	226
40 per cent	259	255	252	244	...	239	224	241	246	236	223	241	244
50 per cent	279	278	268	263	291	252	248	266	267	258	245	263	263
60 per cent	299	298	284	284	...	275	270	288	289	280	267	285	282
70 per cent	319	316	304	307	...	300	295	309	310	302	292	308	303
80 per cent	341	340	322	333	...	320	322	335	334	326	319	332	326
90 per cent	365	360	348	361	364	353	350	363	360	350	352	359	354
Endpoint	401	399	399	398	402	399	399	400	398	400	398	402	399
Per cent distilled over	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.5	98.0	98 0	98.5
Per cent bottoms	1.0	1.3	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Per cent loss	0.5	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	0.5
Octane number (M.M.)	....	28	44	45	45	49	28	23	26	25	55	...	...

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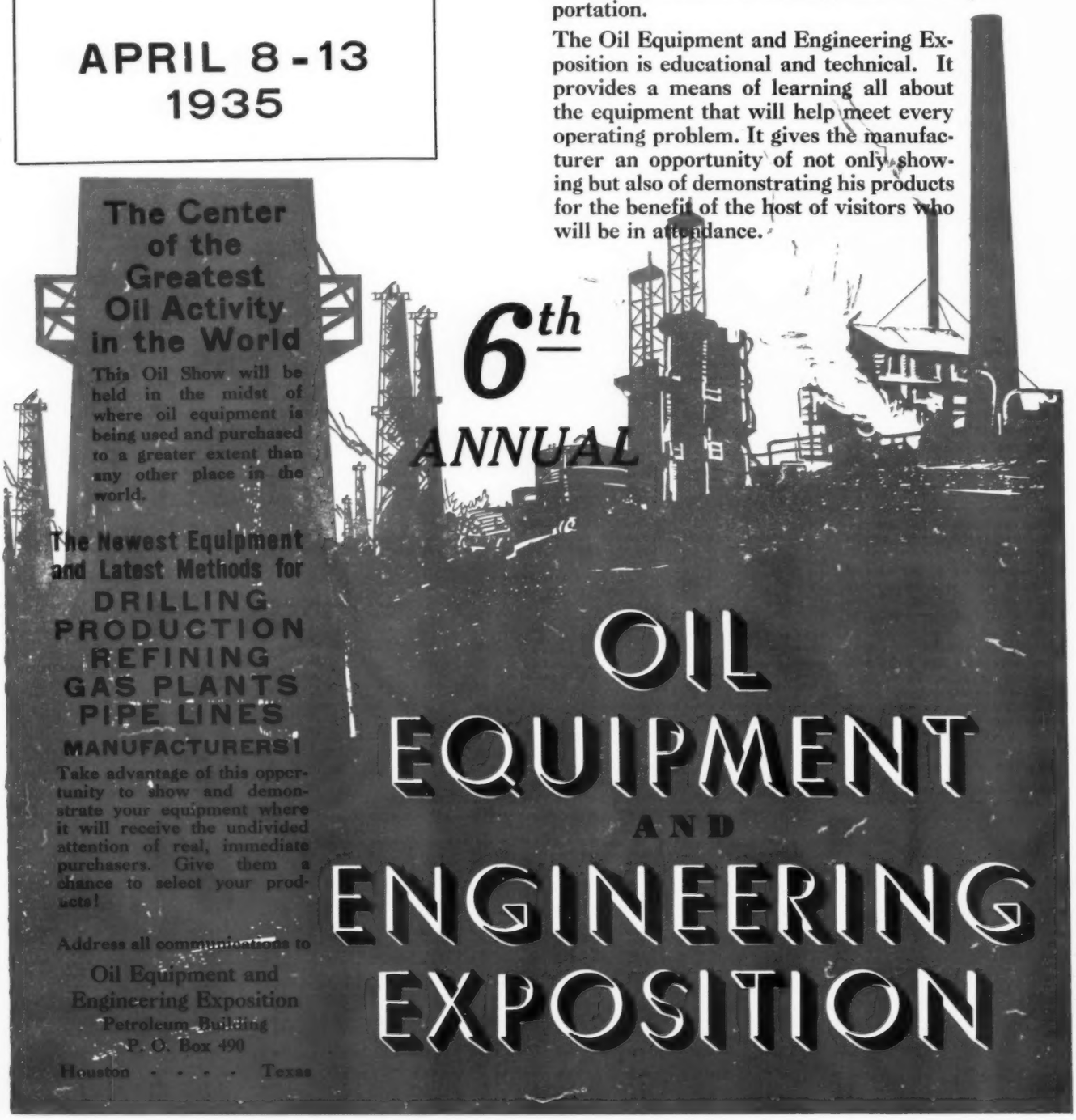

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compared to many other Michigan crudes. The 400° F. endpoint gasoline has an octane number of 44 whereas Mount Pleasant gasoline showed 22 octane.

An analysis of Hart crude is given below:

PROPERTIES OF HART CRUDE OIL

Gravity, °A.P.I.	35.5
Cold test, °F.	55
B. S. & W., per cent	0.2
Sulphur, per cent	0.42

100 cc. Distillation

	°F.
I.B.P.	156
Per cent distilled over:	
5 per cent	201
10 per cent	245
20 per cent	325
30 per cent	410
40 per cent	499
50 per cent	584
60 per cent	669
70 per cent	711
80 per cent	715
90 per cent	723
Endpoint	743
Per cent over	98.0
Per cent coke by weight	2 5
Per cent at 400° F.	28.5
Per cent at 437° F.	33.0
Per cent at 572° F.	49 0

This crude oil was fractionated into three gasolines of 275°, 325° and 400° F. endpoint, to determine their octane values. The yields and properties of the gasolines are given in Table 11, as well as the fuel oil residues resulting from the atmospheric distillation operation.

A run was made on the Hart crude in a semicommercial topping still which produced 30 per cent of 400° F. endpoint gasoline and fuel oil of 69 per cent of 27.1 A.P.I. gravity with 1 per cent loss. Analyses of these two products are given in Table 12.

TABLE 12—YIELDS, PER CENT BY VOLUME OF THE CRUDE OIL

Gasoline	30.0
Fuel oil residue	69.0
Loss	1.0

Analyses of products:	Gasoline	Topped crude
Gravity, A.P.I.	58.3	27.1
Spe. grav. at 60° F.	....	0.8922
Flash (C. O. C.), °F.	....	250
Fire (C. O. C.), °F.	....	275
Flash (Pen.-Mart.), °F.	....	225
B. S. & W., per cent	....	Trace
Cold test, °F.	....	70
Vis., Furol at 122° F.	....	14
Sulphur, per cent	0 09	0.50
Color, Saybolt	16	.. .
Doctor test	Pos.	....
Oct. No. (motor method)	44	....

100 cc. Engler Distillation

	°F.	°F.
I.B.P.	130	440
Per cent distilled over:		
5 per cent	169	478
10 per cent	185	503
20 per cent	209	548
50 per cent	269	704
90 per cent	353	740
Endpoint	393	740
Per cent over	98 0	95.5
Per cent bottoms	1.0	....
Per cent coke by weight	....	4.7
Per cent loss	1 0	....
Per cent at 572° F.	....	24.5

Cracking Runs

The fuel oil residue was subjected to a temperature of 940° F. and 200 pounds pressure in a continuous manner producing from 51 to 62 per cent of gasoline of 65 octane number, with cracked residue ranging from 40 to 25 per cent. The results of the three cracking runs are shown in Table 13.

TABLE 13—YIELDS VOLUME PER CENT OF FUEL OIL RESIDUE

Gasoline	51.5	58.6	61.8
Residuum	40.0	29.1	24.8
Gas and loss	8.5	12.3	13.4
Gas—cu. ft./bbl. charging stock	490	563	620

Analyses of Products

Untreated gasoline:			
Gravity, °A.P.I.	60.9	60.0	60.6
Color, Saybolt	....	....	11
Doctor test	....	....	Pos.
Sulphur, per cent	....	....	0.08
Gum, Mg./100 cc. (copper dish):			
Without inhibitor	....	....	34
With Univ. inhibitor, (0.025 per cent)	....	....	9
Oxygen bomb stability, induction period, minutes:			
Without inhibitor	....	....	230
With Univ. inhibitor, (0.025 per cent)	....	....	345
Oct. No. (M. M.)	65	65	65

100 cc. A.S.T.M. Distillation

	°F.	°F.	°F.
I.B.P.	96	98	98
Per cent distilled over:			
5 per cent	126	128	128
10 per cent	144	146	144
20 per cent	178	179	178
50 per cent	264	276	276
90 per cent	372	376	370
Endpoint	396	402	400
Per cent over	95.0	97.0	97.0
Per cent bottoms	1.0	1 0	1.0
Per cent loss	4.0	2.0	2.0
Cracked residue:			
Gravity, °A.P.I.	14.5	7.3	3.3
Flash (C. O. C.), °F.	305	285	....
Fire (C. O. C.), °F.	315	320	....
Flash (Pen.-Mart), °F.	165	160	....
Vis., Furol 122° F.	33	117	481
Cold test, °F.	50	25	....
B. S. & W., per cent	0 1	0.9	1.6
I.B.P., °F.	446	460	....
Per cent distilled at 572° F.	12.0	10 0	....

The yields of gas, gasoline and residuum are shown in Figure 2 with the relationship of A.P.I. gravity and viscosity of the cracked residuum.

TABLE 7—RESULTS FROM REFORMING 400 ENDPOINT STRAIGHTRUN GASOLINE
Yields—Volume Per Cent of Charging Stock

Gasoline	81.6	74.1	72.0	67.5	63.9
Residuum	3.5	4.5	4.4	3.4	4.3
Gas and loss	14.9	21.4	23.6	29.1	31.8
Total	100.0	100.0	100.0	100 0	100.0
Gas—cu. ft./bbl. charging stock	391	559	684	726	809

Analyses of Products

Untreated gasoline:					
Gravity, °A.P.I.	63.0	62.4	62.2	61.6	61.0
Color, Saybolt	....	....	12	....	....
Doctor test	....	....	Pos.	....	....
Sulphur, per cent	....	....	0.04	....	....
Octane No. (C.F.R. method)	51	56	61	63	67
	100 cc. A.S.T.M. Distillation				
I.B.P., °F.	105	97	101	97	94
Per cent distilled over:	°F.	°F.	°F.	°F.	°F.
5 per cent	136	130	126	127	123
10 per cent	154	148	143	143	142
20 per cent	182	177	168	171	168
50 per cent	252	243	239	239	236
90 per cent	368	357	355	359	360
Endpoint	396	393	385	390	396

TABLE 8—ANALYSIS OF CRACKED RESIDUE

Residuum gravity, °A.P.I.	16 2	14.7	15.6	(*)	8.5
	100 cc. Engler Distillation				
I.B.P., °F.	226 °F.	220 °F.	210 °F.	(*)	320 °F.
Per cent distilled over:					
5 per cent	386	426	403	(*)	446
10 per cent	452	466	441	(*)	470
20 per cent	490	496	469	(*)	494
50 per cent	555	560	531	(*)	586
90 per cent	751	(†)	(†)	(*)	760
Endpoint	751	760	733	(*)	760
Per cent over	89.0	90.5	90.0	(*)	87.0
Per cent coke by weight	12.0	9.6	9.9	(*)	12.7
Per cent at 400° F.	6.0	3 5	4.5	(*)	0.5
Per cent at 572° F.	56.0	54.5	61 0	(*)	52.5

*No analysis. †Cracking.

TABLE 10—RESULTS OF SIX SETS OF CRACKING CONDITIONS
Yields—Volume Per Cent of Charging Stock

Gasoline	43.5	54.0	59.1	49.6	53.3	54.4
Residuum	51.9	39.2	33.8	42.5	37.9	36.0
Gas and loss	4.6	6.8	7.1	7.9	8.8	9.6
Gas—cu. ft./bbl. charging stock	376	515	571	520	546	606

Analyses of Products

Untreated gasoline:						
Gravity, °A.P.I.	61.1	60.9	59.7	62.8	61.1	62.1
Color, Saybolt	....	....	....	....	....	....
Doctor test	....	....	....	....	....	....
Gum, Mg./100 cc. (copper dish):						
Without inhibitor	....	29	....	....	....	....
With inhibitor (.01 per cent)	....	12	....	....	....	....
Sulphur, per cent	....	0.06	..	....	..	....
Oxygen bomb stability—induction period, minutes:						
Without inhibitor	....	230	....	....	....	....
With inhibitor (.01 per cent)	....	430	....	....	....	....
Octane No.—motor method	64	64	65	65	66	65
	100 cc. A.S.T.M. Distillation					
I.B.P.	82 °F.	98 °F.	88 °F.	86 °F.	96 °F	88 °F.
Per cent distilled over:						
5 per cent	118	122	124	118	124	120
10 per cent	126	140	145	136	144	139
20 per cent	172	176	180	168	176	170
50 per cent	258	261	272	248	256	250
90 per cent	370	374	382	350	354	352
Endpoint	400	396	404	381	386	385
Per cent over	96.0	95.0	95.0	94.0	95.5	95 0
Per cent bottoms	1.0	1.0	1.0	1.0	1.0	1.0
Per cent loss	3.0	4.0	4.0	5.0	3.5	4 0
Cracked residue:						
Gravity, °A.P.I.	13.6	7.2	5.0	10.1	7.0	6.8
Specific gravity @ 60° F.	0.9752	1.0201	1.0366	.9993	1.0217	1.0231
Flash (Cleveland Open Cup), °F.	....	275	305	285	....	310
Fire (Cleveland Open Cup), °F.	....	340	360	345	....	365
Flash (Pensky-Martens), °F.	....	155	170	165	....	160
B. S. & W., per cent	0.4	1.4	1.6	0.4	0.5	0.6
Cold test, °F.	....	25	40	5	....	25
Vis., Furol @ 122° F., secs.	47	129	295	67	123	134
I.B.P., °F.	....	450	451	437	....	426
Per cent @ 572° F.	....	6.5	4.5	6.5	....	5 0

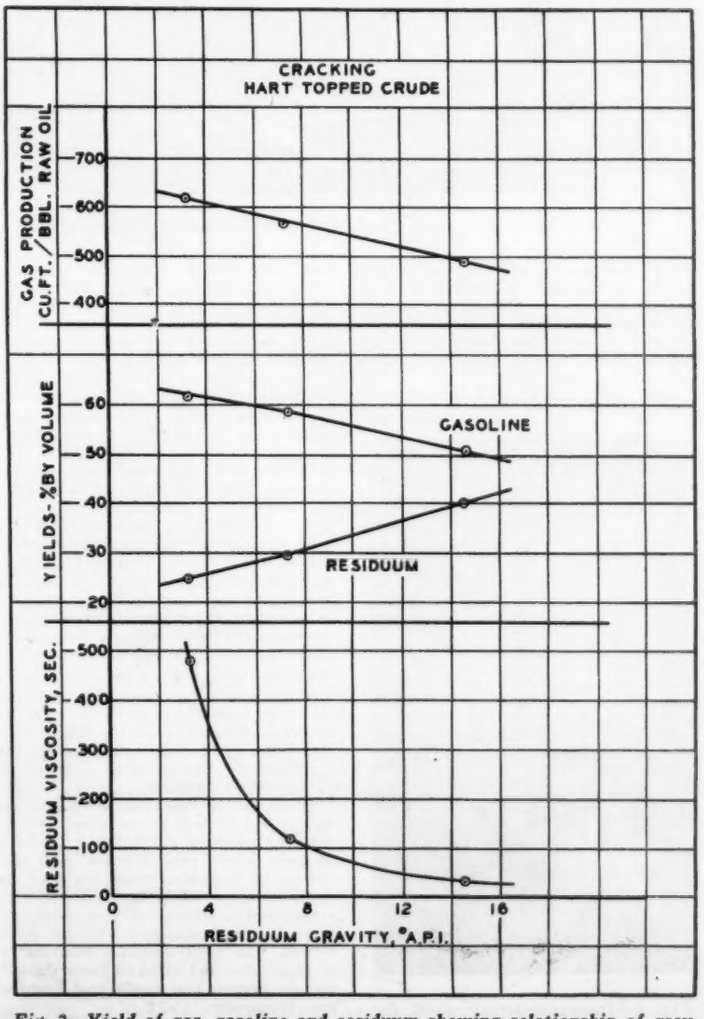

Fig. 2—Yield of gas, gasoline and residuum showing relationship of gravity, and viscosity of the residuum when cracking Hart topped crude

Program of Road Tests Inaugurated in California by Ethyl Corporation

By EARL BARTHOLOMEW and HOMER H. DEDO
Ethyl Gasoline Corp.

The ever widening range of internal combustion engine operating conditions adds to the complexity of the problems in connection with progress toward better engines and improved fuels. These changes necessitate a correspondingly diversified experimental program on fuels and engines. Engines must operate satisfactorily while generating power for lighthouses off the coast of Florida and aerial beacons in the high-snow-capped passes of the Rocky Mountains, while pulling a load of 80,000 pounds at high speed and wide-open throttle over the Arizona desert, and while operating milk delivery trucks which travel a total of only 10 miles per day.

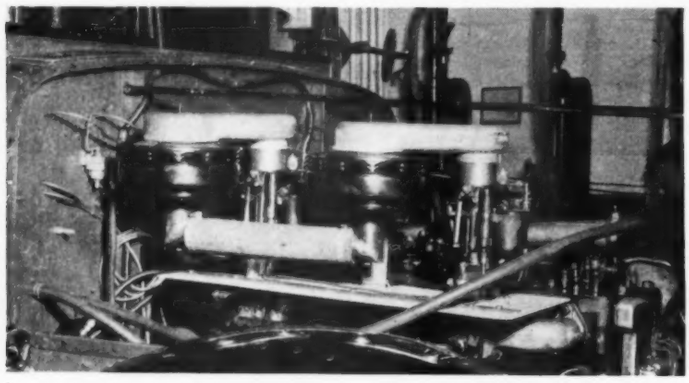

Fig. 1—Dual carburetor and air cleaner assembly for trucks

Obviously no single type of engine operating under a limited range of conditions can possibly answer all questions that arise in the broad field of gasoline utilization. Laboratory tests simulating road test conditions render useful information. The fund of test data is increased by observing vehicles in fleet service and vehicles in operation on proving grounds where a wide variety of test conditions can be set up. However, there are common types of operation which are difficult to approach by artificial means. For example, trucks running in the western part of this country in a single trip are required to climb steadily for 100 miles or more while approaching each of several passes having elevations from 4,000 to 7,000 feet and to descend similar grades after having crossed the passes. In the same trip it may be necessary to descend to elevations below sea level and to travel hundreds of miles over desert roads on which no speed limit exists. Part of the trip may be made on a moderately cracked high-sulphur California gasoline, another portion on a severely cracked low-sulphur Mid-Continent gasoline and perhaps the third part on a lubricated gasoline of some other type. The combinations of grades, elevations, temperatures, speeds, fuels, and oils are almost endless.

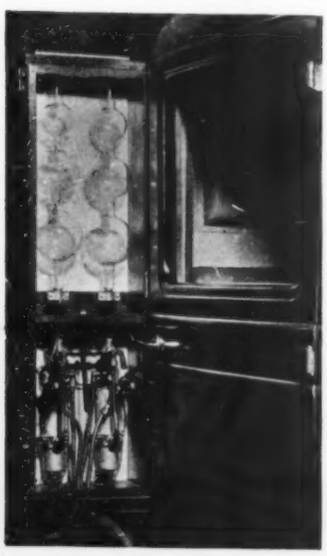

Fig. 2—Instrumentation used for measuring gasoline consumption on all vehicles with dual carburetion

In order to add to its knowledge of the operation of engines under conditions differing from those at Detroit, the engineering laboratory of the Ethyl Gasoline Corp. decided some time ago to start a series of tests at some point in the Southwest where almost any desired combination of operating conditions can be set up. Several states were surveyed for test condition possibilities. Charts of altitude versus road distance were plotted for all promising roads, the load carrying capacity of bridges investigated, traffic and weather conditions noted, and local fire and highway officials interviewed. The most desirable combination of conditions and circumstances suitable for the present test needs was found at San Bernardino, Calif.

The principal roads to be used for test purposes are in the San Bernardino Mountains and on the Mojave Desert. The elevations on these roads vary from more than 200 feet below to approximately 7,000 feet above sea level. On one road the elevation changes almost 6,000 feet in 35 miles, 12 per cent grades occurring at some points. The Muroc Dry Lake on the Mojave Desert has a length of 12 miles and, because of its remarkable flatness and smoothness, permits indefinitely sustained speeds as high as engines are capable of producing.

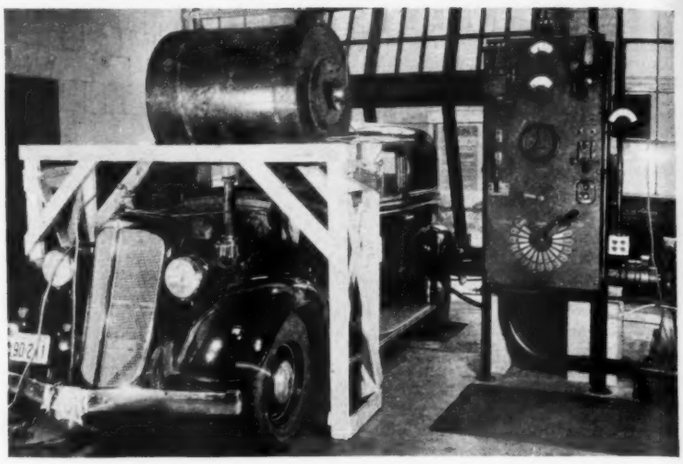

Fig. 3—Passenger car attached to chassis dynamometer for air and fuel consumption measurements and preliminary tests

On these proving grounds it is planned to investigate numerous problems in commercial vehicles, passenger cars, and farm tractors, some of which are as follows:

(1) The economy of high compression and high octane gasoline versus low compression and low octane gasoline in connection with heavily loaded trucks operating in mountainous country.

(2) The relation of air-fuel ratio to fuel problems.

(3) The effect of type and concentration of sulphur compounds on fuel behavior in engines.

(4) The effect on engine performance of lubricants added to gasoline.

(5) The economy, performance, and durability of farm tractors operated on distillate at low compression and on 70 octane gasoline at high compression, these tests to be made on the Mojave Desert and to be a continuation of the long series of tests made recently in the laboratory at Detroit.

Other problems will be investigated from time to time as the need arises.

For some time preparatory work has been in progress at the Detroit laboratory on arranging the equipment for conducting comparative fuel tests simultaneously, equipment instrumentation, calibration of the test assemblies, and arrangement of detailed test form sheets for recording and reporting test data. All the trucks and passenger cars are equipped with dual carburetors, gasoline pumps, and tanks providing for the delivery of one type of fuel to one half the cylinders and another fuel to the remaining cylinders. The carburetion scheme is special and has been developed after much experimental work. Figure 1 shows the carburetor and air cleaner assembly for the trucks. In order that daily checks may be made on the characteristics of each carburetor, other than that indicated by total fuel consumption, a system of glass bulbs and pipettes and valves assembled in a box with the fuel pumps has been installed on each vehicle which will permit the fuel consumption of the two carburetors to be checked simultaneously on the road under any conditions of operation. A photograph of this instrument assembly attached to a truck is shown in Figure 2.

Considerably improved testing technique is expected to result from the dual carburetor idea because of the elimination of such variables as differences in weather, drivers, road conditions, engine conditions, engine age, and other factors which, although always controlled

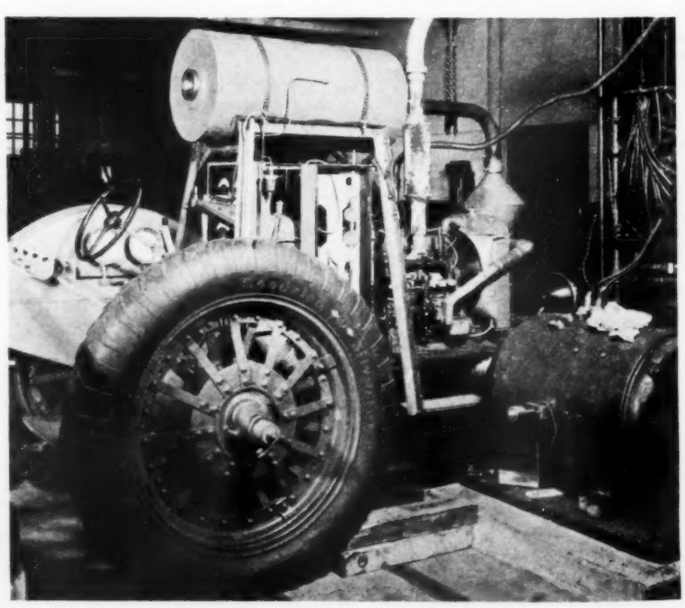

Fig. 4—Views of farm tractor attached to dynamometer for preliminary test and calibration work

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2 Seats designed so that high fluid-velocity through seats immediately before closing removes dirt and scale.

3 Iron Body of finest gray iron having highest strength and density.

4 Deep Stuffing Box with Packing Follower prevents leakage around stem and requires less frequent re-packing.

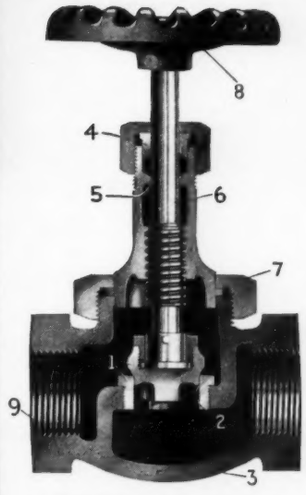
5 Valve can be re-packed under pressure when either wide open or closed, as a seat is formed under stuffing box.

6 Oversize Bronze Stem in Bronze Bonnet prevents rusting or sticking of stem in bonnet.

7 Bronze Union-Ring attaching Bonnet to Body gives added rigidity and, since threads cannot corrode, valve may be easily taken apart after years of use.

8 Malleable Iron Non-Heating Handwheel attached to stem with bronze nut.

9 Long Pipe Threads.



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as carefully as possible, are always subject to uncontrollable variation during different periods.

Normally it will be desired to maintain constant air-fuel ratios for the two carburetors installed on a given vehicle. Tests with vehicles on the chassis dynamometer and road have indicated that the metering characteristics of the two carburetors can be made to coincide very closely over the entire load and speed range. Needless to say, many problems arose during the calibration which had to be solved before further progress could be made.

For example, some difficulty was encountered in maintaining the desired relation for air consumption and manifold vacuum between the two manifolds. This trouble may have been introduced as a result of closing the pressure equalization passageway between manifolds. To eliminate this trouble, the two air cleaners were connected with a tube for equalization purposes, as shown in Figure 1. One of the passenger cars attached to the chassis dynamometer for air and fuel consumption measurements and other preliminary tests is shown in Figure 3.

On the road it is planned to make many measurements, some of which are vehicle performance, fuel consumption, and compression pressures. Exhaust gas samples from each series of cylinders operating on a given fuel are to be collected and analyzed in order that the effect of altitude on carburetor metering characteristics may be studied.

Tractor Tests

The tractor tests are interesting because of the thoroughness with which the comparison of distillate and 70 octane gasoline is being made. Power and economy are being measured at each of three stages of manifold heat, and at various compression ratios over a wide range of mixture ratios under each set of conditions. In so far as possible the test instruments used in the laboratory have been mounted on the tractors themselves so that they can be driven on the road with all instruments intact and usable. Power absorption in the laboratory test work was provided with a standard cradle type electric dynamometer which was connected to the power take-off on the tractor with pulleys and belts of the V-type. Figure 4 shows the equipment assembled for testing in the laboratory. Variable power absorption on the desert will be provided by means of another towed tractor equipped with a V-belt driven water pump whose discharge pressure and capacity can be varied to produce the variable loading required. A tank, fan, and radiator are provided for the dissipation of the heat generated by the pump. This power absorption system is independent of the engine in the towed tractor which must be kept intact for the towing of the tractor under test when compression pressures and overall tractor friction are to be measured.

The following automotive equipment has been equipped with instruments, calibrated on dynamometers and on the road during the past few months, and transferred to San Bernardino, Calif.

2 General Motors Model T85A truck tractors with Model 616 engines and semi-trailers.
1 White Model 641 truck tractor with Model 5A engine, and a semi-trailer.
1 Mack Model BX truck tractor with a Model CF engine, and a semi-trailer.
1 Buick "40" car.
1 Oldsmobile 8 car.
2 Ford V-8 cars.
2 Minneapolis-Moline farm tractors with extra engines, manifolds, and other equipment.

It is planned to operate the truck equipment 24 hours per day, the tractor equipment eight hours per day, and the passenger cars on a less rigid schedule.

Petroleum Coke Makes Ideal Household Fuel When Its Properties Are Understood

By O. F. CAMPBELL
Sinclair Refining Co.

Petroleum coke is an ideal solid fuel for domestic heating and its use should be encouraged wherever it is available. Anyone who has used this fuel for household purposes is unwilling to use any other fuel even in localities where the best grade of coal or coke produced from coal is available. Considerable trouble has been encountered in the burning of this fuel on the part of some of the users and occasionally petroleum coke has been condemned as an unsatisfactory fuel for domestic use. Difficulties encountered have been primarily due to lack of knowledge of firing and trying to burn petroleum coke in a furnace not suitable for coke burning. It is, therefore, the purpose of this article to point out some of the more important methods used in obtaining satisfactory results.

Petroleum coke varies in characteristics which depend upon the type of equipment and coking process used, and the kind of charging stock coked. Petroleum coke is usually produced by one of three methods (1) shell still coking, (2) coking in chambers which are a part of cracking still, and (3) by the Knowles Process. Shell still coking, the first process producing petroleum coke, is accomplished by charging to the coking chamber a petroleum product which is then distilled to dryness. The coking chamber usually consists of a steel shell about 14 feet in diameter and 40 feet long in a horizontal position. The oil is charged to the chamber and heat is applied to the lower half of the chamber. The oil is distilled to dryness after which the dry residue, coke, is cleaned out manually or mechanically. The grade of coke thus produced varies slightly as to kind of charging stock and the manner or rate in which the heat is applied. Producing coke in chambers which are a part of a cracking still is accomplished by utilizing the heat from a cracking still heating coil instead of using external heat for distillation to dryness. The coking chambers are about the same size as for shell still coking and are usually vertical instead of horizontal. The grade of coke thus produced also varies depending upon the charging stock, and temperature and pressure maintained in the coking chamber. The coke is removed from the coking chamber mechanically. Coking is accomplished in the Knowles Process by evaporating a petroleum product to dryness in an externally fired refractory lined chamber. This coke is usually very hard and dense, resembling coke produced from coal in a coke oven, and is an excellent fuel for domestic use. The coke is removed from the coking chamber mechanically in substantially the same manner as is coke oven coke. Table 1 reflects the general characteristics of petroleum coke from various sources of charging stock.

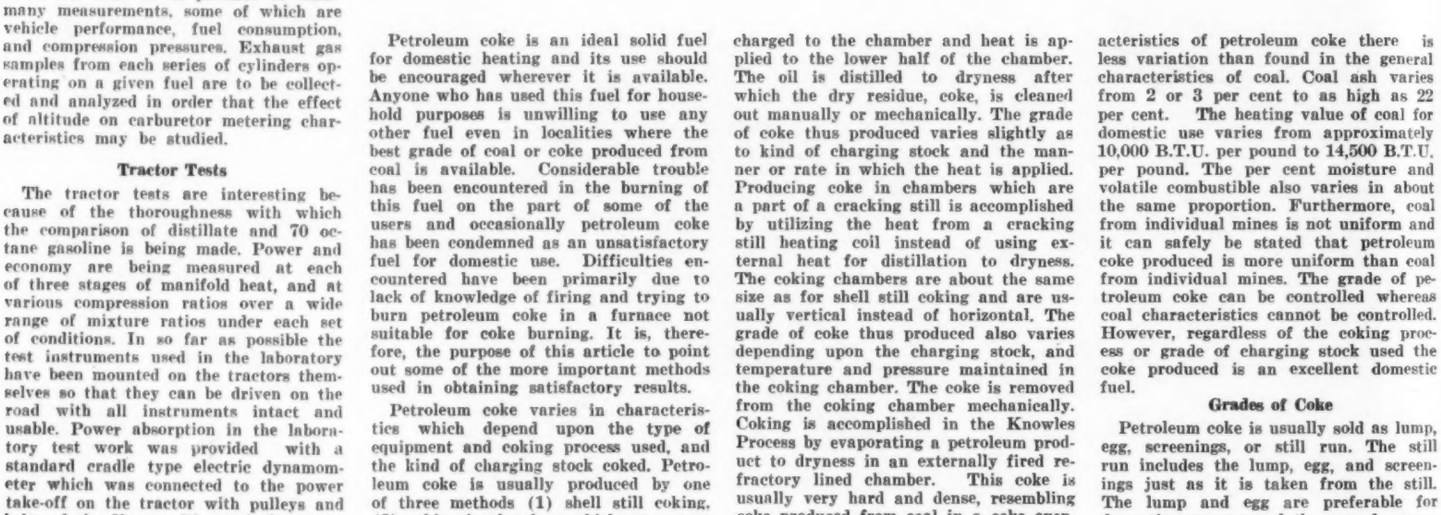
Although the tabulated analyses show an appreciable variation in general characteristics of petroleum coke there is less variation than found in the general characteristics of coal. Coal ash varies from 2 or 3 per cent to as high as 22 per cent. The heating value of coal for domestic use varies from approximately 10,000 B.T.U. per pound to 14,500 B.T.U. per pound. The per cent moisture and volatile combustible also varies in about the same proportion. Furthermore, coal from individual mines is not uniform and it can safely be stated that petroleum coke produced is more uniform than coal from individual mines. The grade of petroleum coke can be controlled whereas coal characteristics cannot be controlled. However, regardless of the coking process or grade of charging stock used the coke produced is an excellent domestic fuel.

Grades of Coke

Petroleum coke is usually sold as lump, egg, screenings, or still run. The still run includes the lump, egg, and screenings just as it is taken from the still. The lump and egg are preferable for domestic purposes and the use of screenings should be discouraged unless the users are exceptionally familiar with petroleum coke firing. Still run is a good solid fuel for home heating as the screenings can be readily blended off with the egg and the lump. The lump and egg sizes are cleaner fuels as the screenings have been eliminated.

The lump size is an ideal fuel for a

Enlarged Vacuum Pressure Distillation Unit in Socony-Vacuum Plant



The Socony-Vacuum Oil Co., Inc., recently completed a program of revisions in its White Eagle division plant at Augusta, Kan., including the vacuum pressure distillate and asphalt units shown above

fireplace. When lump coke is burned in a fireplace no smoke is produced and the clean glowing lumps of coke radiate heat to the room very effectively. There is also but a small amount of ashes to be removed from the fireplace and there is less danger of sparks setting the rug on fire as when burning wood or some coals. A living room equipped with a fireplace is usually much cleaner when burning petroleum coke than when burning any other type of solid fuel.

To start a petroleum coke fire proceed as one would do when starting a coal fire. Use kindling wood and ignite with paper, or wood shavings. Coke ordinarily ignites more slowly than coal and usually requires more kindling wood. After the fire is started with wood add some lumps of coke and allow the coke to ignite before adding more coke. After the coke is once ignited and a good glowing fuel bed is obtained the furnace may be filled with lump or egg coke and the fire will not die out. A coke fire can be readily smothered with fine coke screenings.

Limit Draft

When burning petroleum coke care should be taken to see that the furnace doors will close tight, and there is little or no chance for air leakage into the furnace. The furnace firing door should fit tight as little or no air is required over the fuel bed. The ash pit door should be a tight fit so that the fuel burning rate can be controlled by the draft door which should also be a tight fit. A great many home furnaces have so much air leakage around the dampers and doors that a coke fire will readily burn with all dampers and doors shut. If the furnace is in such condition that the doors are broken or warped so that they will not shut off the air it would be best not to try to burn coke. All of the air for the furnace should pass up through the grates and should be controlled by the operation of the draft damper beneath the grates. Some hot air furnace fireboxes are lined with refractory and are not satisfactory for coke burning due to trouble with clinkers.

Small Amount of Ash

Petroleum coke has only a small amount of ash with usually less ash in the lump and egg than in the screenings (or breeze). Although the ash content is small it will produce clinkers above the grates whether burned in a hot water, steam, or hot air furnace. Clinkers will form on the side walls of a hot air furnace and if this type of furnace has a refractory lining clinkers form so rapidly that coke is not recommended. The clinkers cause but little trouble on the side walls of a hot air furnace without a refractory lining and cause no trouble on a hot water or steam furnace. When burning screenings from shell still coke clinkers form so rapidly above the grates that screenings are not recommended.

During the winter months the usual custom is to dispose of garbage in the furnace instead of the garbage can. Garbage burned in any solid fuel furnace lowers the fusion point of the ash of the fuel and causes more clinkers than if garbage were not burned in the furnace. Garbage disposal in the furnace should therefore be discouraged for any solid fuel burning furnace and especially a petroleum coke burning furnace.

When burning petroleum coke it is necessary to have a clinker bed about two or three inches thick just above the grates. Some type of coal is usually used just prior to burning coke and the ash from the coal forms an ideal base for the proper clinker formation. Some users prefer to have a small amount of high fusion ash coal on hand to control the clinker formation but this is not necessary. There is usually enough ash from the coal previously burned to provide the proper clinker depth but if no coal has been used some broken up brick may serve to start the clinker formation. If the grate is covered with broken brick about 2" x 2" x 2" in size, coke may be burned satisfactorily without danger of burning the grates. In the past a steel plate drilled with half inch holes on one and one-half inch centers has been placed on the grates to serve as a protection for the grates. This practice is not recommended as the holes soon plug up and the plates must be removed and cleaned. A clinker bed once formed should not be removed as it offers a protection for the grates. Practically all of the trouble with burned out grates is on account of siftings piling up under a portion of the grates shutting off the air which allows the grates to become overheated. If the siftings are not removed it is possible for the siftings to burn and melt the grates.

After the proper clinker bed is formed firing of petroleum coke is a simple procedure. If the fire does not respond quickly enough with the damper open there may be too much clinker or the clinker may have fused. The clinker should be removed in the coldest weather about once a week and then only one or two of the larger clinkers. If the clinker bed is not too deep it only requires breaking up with a rather heavy round iron bar about one-inch in diameter either through the firing door or clinker door. If the clinker bed gets too thin some of the clinker which has previously been removed should be broken up and put back with the fuel to increase the level. Any siftings that fall through the grates should be returned to the furnace and burned so that only solid clinker is eventually removed from the furnace, and all of the combustible is burned. There should be substantially no combustible in the ash. All clinkers should be removed through the firing door with a pair of tongs, clinker hook, or shovel.

The amount of clinker for a heating season is about a wash tub full and the clinker is usually carried out at the end of the heating season. Petroleum coke has approximately 1 per cent ash and if 10 tons were burned in a heating season there would only be a maximum of 200 pounds of clinker for a heating season.

Fuel Bed

The fuel bed should be kept as thick as possible when burning petroleum coke. The fuel bed should be at least 12 inches deep. A thicker fuel bed does no harm and an 18 or 20-inch fuel bed is about normal for good results. Each time the furnace is fired the furnace should be filled. Coke screenings or fines require more draft than either lump or egg sizes as there is more resistance to the air passing upward through the fuel bed due to a more compact fuel bed. If screenings are used it is more essential to have a tight furnace than when burning still run, egg, or lump sizes.

Petroleum coke contains more heat units per pound and has a higher theoretical efficiency than tthe best grade of coal. Coke produced from coal has a slightly higher theoretical efficiency than petroleum coke but coal coke has more ash and less heat units per pound. Petroleum coke consists primarily of carbon and hydrogen. The percentage of fixed carbon is higher for petroleum coke than for any solid fuel and the percentage of hydrogen is less than the best coal available and slightly higher than coke oven coke. Consequently there is less hydrogen loss with petroleum coke than for any other solid fuel except coke oven coke. The volatile combustible material of petroleum coke varies with the method of coking as shown by coke analyses tabulation and is usually highest in coke produced from coking chambers of cracking stills and least in coke produced by the Knowles Process. The higher the percentage of volatile the more readily the coke is ignited and for the same draft burns up faster than the lower volatile combustible coke. On the other hand, the lower volatile coke burns more uniformly and will maintain a fire longer. Either high or low volatile combustible coke is an excellent fuel and it is a matter of preference or opinion on the part of the user as to which kind of coke is the better.

Advantages of Coke

One of the main advantages of petroleum coke over the other solid fuels is that it requires less attention and a lesser number of trips to the basement. If the firebox is large enough it is only necessary to make one trip to the basement each day. However, for the average furnace two trips to the basement daily are enough even during the coldest weather and when the weather is mild one trip to the basement is sufficient. If the home is equipped with thermostatic control the temperature can be controlled within one or two degrees of the thermostatic setting. When using thermostatic control with other solid fuels, the ash offers resistance to the air supply and does not give the sensitivity of control as compared with coke.

With reference to the economy of burning petroleum coke compared with other solid fuels this depends on the price of coal and coke which varies for different locations and freight rates. A ton of petroleum coke contains more heat units than the best grade of coal. In addition to more heat units per ton the consumer gets more usable heat units out of the coke heat units than can be obtained from the heat units in coal. Due to the manner in which coke burns the consumer actually gets more heat units absorbed or more usable heat units. If the coal and coke contained an identical number of heat units per ton there would be more usable heat units in a ton of coke. When burning coal there is an appreciable ash pit loss and also an unburned fuel loss up the chimney which is high, especially immediately after firing the furnace.

No attempt was made in this paper to discuss the use of petroleum coke for stoves or baseburners and the comments deal primarily with coke burning furnaces in homes. It is, however, generally understood that lump coke or egg size burns very satisfactorily in some types of stoves and baseburners.

TABLE 1.—COKES DERIVED FROM THE CRACKING OF HEAVY OILS FROM VARIOUS FIELDS WERE ANALYZED.[1]

Coke source from fuel oils—	H_2O Per cent	Vol. matter Per cent	Free carbon Per cent	Ash Per cent	Sulphur Per cent	B.T.U. per pound
Mid-Continent	0.50	8.07	91.81	0.05	0.83	15,645
Mid-Continent	0.30	12.93	85.63	1.14	1.44	15,300
Mid-Continent	1.07	10.83	87.65	0.45	0.87	15,568
Texas	0.15	15.02	83.21	1.62	1.96	15,456
Panhandle, Tex.	3.31	14.00	81.12	1.59	0.45	15,573
Smackover, Ark.	0.11	12.28	87.15	0.46	4.18	15,898
Smackover, Ark.	3.33	17.02	79.20	0.45	3.70	15,454
Kentucky	0.39	11.65	87.42	0.54	0.66	16,403
Pennsylvania	0.20	11.39	87.42	0.99	0.22	16,248
Pennsylvania	0.46	10.07	88.92	0.05	0.45	15,573
California	0.47	18.03	80.49	0.91	1.09	15,295
California	1.48	13.84	82.29	1.00	1.39	15,322

TABLE 2.—SOME ANALYSES OF COKE PRODUCED BY SHELL STILL COKING.[2]

Source of charging stock—	Mid-Continent and East Texas reduced crude, and heavy cracking still tar	
Moisture	.39	1.30	.64	1.80
Ash	1.23	.66	1.01	.84
V.C.M.	10.31	9.84	8.96	11.26
Sulphur	1.23	1.01	.94	.76
Fixed carbon	88.07	88.20	89.39	86.10
B.T.U. as received	15,330	15,100	15,050	15,510

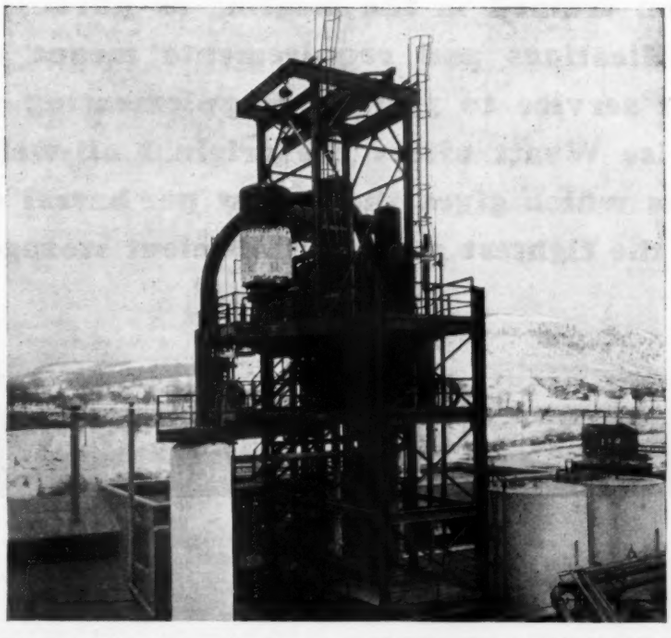
[1] Universal Oil Products Co. analyses. Reference Journal of the Society of Chemical Industry, May 27, 1932.
[2] Sinclair Refining Co. analyses.

TABLE 3.—SOME ANALYSES OF COKE PRODUCED BY THE KNOWLES PROCESS.[3]

Source of charging stock—	Dubbs tar	Cross tar	Cross tar	Mid-Continent vacuum bottoms
Moisture	1.1	.3	.3	.60
Ash	.85	.2	.5	1.80
V.C.M.	5.2	7.3	7.4	2.76
Sulphur	1.15	1.52	.86	1.23
Fixed carbon	92.85	92.20	91.80	94.84
B.T.U. as received	14,515	14,650	14,700	14,400

[3] Some analyses furnished by the H. A. Brassert Co., 310 South Michigan Avenue, Chicago, Ill.

Distillation Unit for Recovery of Solvent



Heater and fractionator for the recovery of solvents at the Sinclair Refining Co.'s Wellsville plant

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Pressure Drop and Heat Transfer in Exchangers

By S. A. PERRONE
Student Graduate, Department of Mechanical Engineering, University of Texas

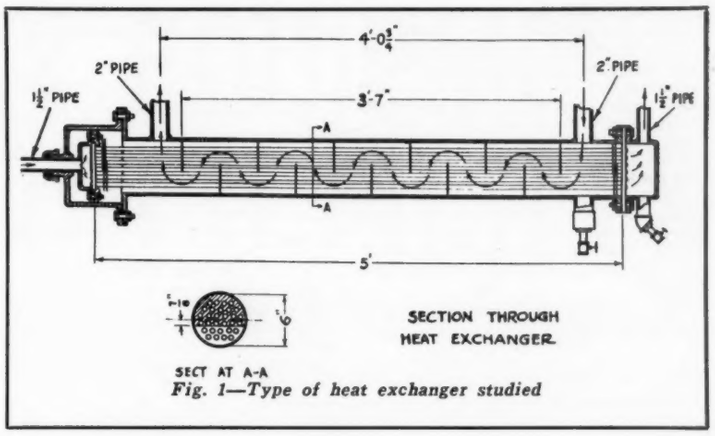

Fig. 1—Type of heat exchanger studied

Shell and tube heat exchangers are extensively used in refinery practice; and hence a knowledge of a method of analyzing the transfer of heat from the hotter to the colder fluid is essential. Ordinarily, the liquid-to-liquid exchangers are fairly long compared to their diameters, and some type of baffle is used on the shell side to create greater turbulence, thereby materially increasing the heat transfer rate. In analyzing the transfer of heat the overall transfer coefficient is determined and broken up into its various components by the resistance concept. The tube side coefficient is easily computed by conventional methods employing dimensionless groups. The latest work along these lines is reported by McAdams[1] and was done by Sherwood and Petrie in 1932 and by Dittus and Boelter in 1930. Both parties arrived at essentially the same relation. When it comes to computing the shell side coefficient, however, greater difficulty is encountered. The information published or otherwise available on this topic is very meager; yet in many cases the shell side coefficient is the more important. McAdams[1] gives a very general correlation for the shell side coefficient of several baffled exchangers employing different types of baffles. The velocity is figured on the basis of free area between the tubes as if there were no baffles. The data vary as much as 70 per cent, however, and the effect of baffle spacing is not even considered.

It is the purpose of this paper to present the results obtained from tests made on a commercial heat exchanger using half-moon or cut-out baffles. An analysis of the average velocity around baffles is presented together with a general correlation of the results, including all variables.

Scope of Work

Tests were run on 10 different tube bundles with various tube diameters and pitches. Data were taken for the calculation of heat transfer and fluid friction losses. The number of baffles used on each tube bundle was varied from 19 to 0, data being taken in general with 19, 15, 11, 7, 3 and 0 baffles. The data on zero baffle condition are not covered in this paper, since this case is a special one. Both tube and shell fluids were water and these results are for cooling the shell fluid, since hot water flowed through the shell. Reynold's number varied from 2,500 to 40,000, where the outside tube diameter and an average velocity around the baffles were used in finding Reynold's number. The method of computing the average velocity is described in a later section. The results herein presented are in general correlated in dimensionless groups.

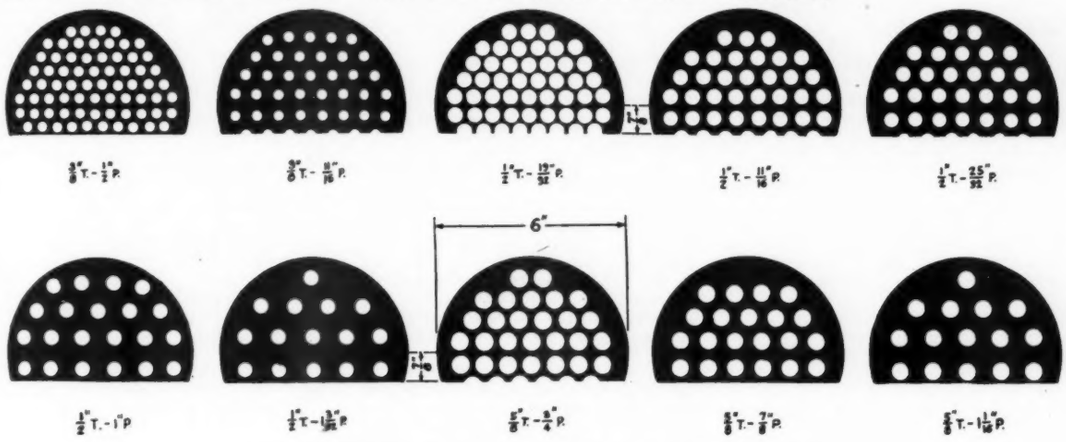

Fig. 2—Arrangement and size of tubes in exchanger bundles

Apparatus and Method

The heat exchanger used in this investigation is shown by Figure 1. The tube bundle shown in the shell has five-eighths inch tubes on seven-eighths inch pitch and 11 baffles equally spaced. A counterflow condition with a single pass arrangement on both shell and tube sides was maintained throughout all tests. The "half-moon" or cut-out baffles and the various tube sizes and pitches used are shown by Figure 2.

The holes in the baffles were drilled one-sixty-fourth inch greater than the tube diameter in order to make conditions more nearly like those in actual practice, and also to facilitate the sliding of the baffles along the tubes when the baffle spacing was changed. The baffles were necessarily smaller than the shell in order for the bundle to be easily removable. The bundles were made up with 19 baffles tacked in place with solder, and when the baffle spacing was to be changed, the surplus baffles were loosened and shifted to the "dead" regions at the ends of the bundle near the tube sheets, where their presence produced no appreciable effect. The drawing in Figure 1 shows four surplus baffles in each "dead" region. An odd number of baffles was used in each case in order to have the same inlet and exit conditions, and the two end baffles were in the same position for all baffle settings.

The arrangement of the apparatus is shown by Figure 3. The rates of flow of both the tube and shell side were measured by means of weighing tanks with stop-watch timing. A check was maintained on the shell side rate by means of a thin plate orifice across which a mercury manometer was connected.

The temperatures were measured by calibrated mercurial thermometers with one-half degree graduations. These thermometers were located so as to assure a turbulent condition at the point of measurement.

The pressure drop across the baffles was measured by a mercury manometer whose tube ends were connected to a manifold from which connections were made to four equally spaced points around the shell at the points of measurement.

The temperature of the incoming shell fluid was held at approximately 140° F. for all tests. No control over the incoming tube fluid was possible, since it was a city water connection. This temperature, however, did not vary appreciably from 60° F.

The rate of flow in the tubes was held constant for each particular bundle and was fixed so as to give a velocity of 2 feet per second for all runs. The only variation in this velocity was due to slight variations in the city water pressure. The shell side rate was controlled by the speed of the pump and was varied from a very low rate to the maximum capacity of the pump for each bundle. The maximum range of average velocity on the shell side for all conditions was from 0.4 feet per second to 4 feet per second.

When the tests were completed on a particular tube bundle, the exchanger was disassembled and cleaned. The bundle to be placed in the shell was given a bath in a weak solution of hydrochloric acid and then placed in the shell, and the exchanger was reassembled. In this way all tests were maintained at practically the same standard of cleanliness.

In order to avoid difficulty from trapped air in elbows, tees, and other "pockets" on the shell side air vents were placed next to the shell side thermometer wells and on the manometer manifolds.

Calculation of Film Coefficients

The mean temperature difference between the shell and tube fluids is quite important in determining the overall co-

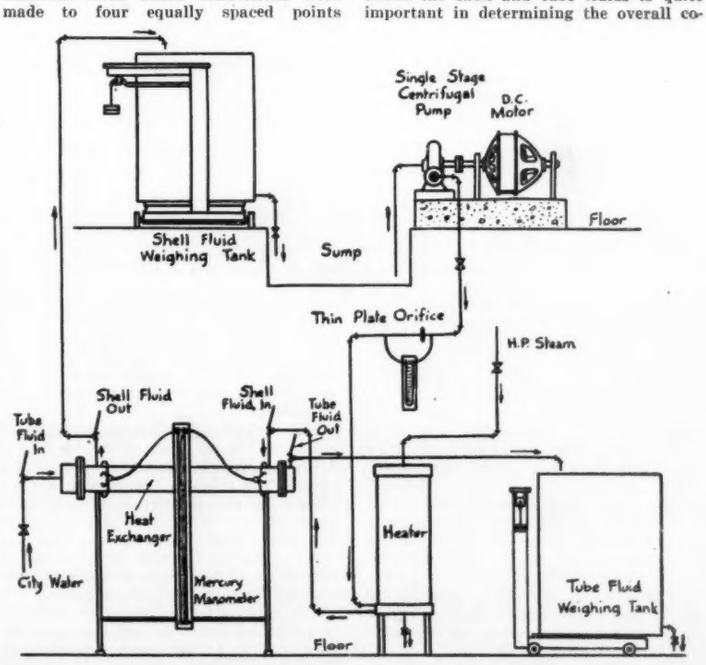

Fig. 3—Arrangement of test apparatus

[1]McAdams, W. H., Heat Transmission.

efficient of heat transfer. Frequently, in practice the arithmetic mean is used and is accurate enough for practical purposes. The log mean temperature difference is accurate for a counter-flow arrangement, but it does not apply in cross-flow. In these tests the flow is partly counter-flow and partly cross-flow, varying as each baffle is passed over; and hence a log mean temperature difference is probably no more accurate than an arithmetic mean. For this reason and because practical men prefer the simpler methods of calculation, the arithmetic mean temperature difference is used in these results.

The overall transfer coefficient was calculated from

$$Q = U A D_m \qquad (1)$$

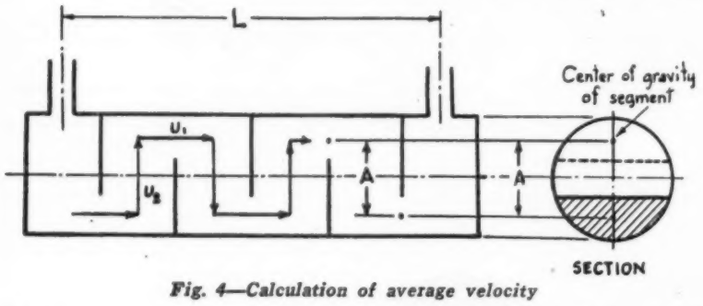

Fig. 4—Calculation of average velocity

where

- Q = rate of heat flow on the tube side, B.t.u. per hour;
- A = external area of tubes, square feet;
- D_m = arithmetic mean temperature difference, °F.
- U = overall transfer coefficient, B.t.u. per hour per square foot per °F. m.t.d.

In order to determine the shell side coefficient, the dimensionless equation of Sherwood and Petrie previously mentioned was used to compute the tube side coefficient. This relation is

$$\frac{h_t D}{k} = .024 \left(\frac{D G}{\mu}\right)^{0.8} \left(\frac{c_p \mu}{k}\right)^{0.4} \qquad (2)$$

where

- h_t = film coefficient of tube side, B.t.u. per hour per square foot per °F. m.t.d.;
- D = inside tube diameter, feet;
- k = thermal conductivity of fluid at average temperature, B.t.u. per hour per square foot per °F. m.t.d. per foot;
- μ = absolute viscosity, pounds per hour per foot = 2.42 × c.p at average temperature of the fluid;
- c_p = specific heat of fluid;
- G = weight velocity, pounds per hour per square foot.

The shell side coefficient was then computed by the resistance concept,

$$\frac{1}{U} = \frac{1}{h_t} + \frac{t}{k} + \frac{1}{h_s} \qquad (3)$$

where

- U = overall transfer coefficient;
- h_t = film coefficient for tube side;
- h_s = film coefficient for shell side;
- t = thickness of tube, feet;
- k = conductivity of tube material.

Average Velocity

The determination of the velocity of flow is one of the most important steps in correlating results or in computing film coefficients. When the velocity varies considerably over the entire path of flow, it becomes difficult to obtain a true average. In a baffled heat exchanger using cut-out baffles, the average cross section of flow is indeed complicated; and so it is to be expected that any relation giving anywhere near an average velocity will be somewhat complicated and will probably require longer computations than are ordinarily necessary.

The average velocity of the fluid in the shell was computed from the velocity u_2, perpendicular to the tubes, velocity u_1, parallel to the tubes, and the total distance traveled by the fluid. Each velocity was multiplied by the fraction of the total distance the shell fluid traveled at this velocity, thus giving the average velocity over the total distance. The sketch shown by Figure 4 indicates the method of analysis.

The velocity parallel to the tubes is computed on the basis of net free area below the baffle shown shaded in the sketch. The tubes in the segment are not shown in the sketch; but their cross sectional area is to be subtracted from the gross area. It is evident that the total distance traveled horizontally is equivalent to the length of the exchanger between inlet and outlet openings.

The velocity perpendicular to the tubes is calculated from the net free area between baffles at the center row of tubes. The cross section perpendicular to the tubes varies, but it would be unnecessarily complicated to account for this in the computations. By taking the velocity at the largest gross cross section the velocity will be somewhat lower than the actual velocity perpendicular to the tubes, and the estimate will be conservative. The vertical distance traveled between two baffles was taken as the distance between the center of gravity of the upper and lower segments, as shown by the sketch. Then, the total vertical distance traveled is the distance traveled between two baffles multiplied by one less than the number of baffles, if the ends beyond the baffles are neglected. In these results end effects are neglected, since they would only complicate the situation. If an accurate analysis is desired, the end conditions should be considered separately; but this is hardly warranted where there is likelihood of experimental error. Besides, the effect of the inlet and outlet on the average velocity will be negligible if the exchanger is fairly long, as is usually the case.

It was mentioned that the holes drilled in the baffles were one-sixty-fourth inch greater in diameter than the tubes and that there was some clearance between the baffle and the shell. These clearances will cause some leakage through the baffles, which undoubtedly will have some effect on the velocity. This effect, however, will be very small, and in this paper it is neglected in order to avoid complications and assumptions of leakage factors.

It might seem unnecessarily complicated to use the center of gravity of the segment to determine the vertical distance traveled, yet this computation is very simple, and it is, seemingly, the only accurate method. The center of gravity of the segment lies on the diameter of the circle perpendicular to the chord, and its distance from the center of the circle is given by,

$$x = \frac{c^3}{12a} \qquad (4)$$

where

- c = length of chord, inches;
- a = area of segment, square inches.

The area must be determined in calculating the velocity parallel to the tubes, and the length of the chord is needed to find the area; so both of these quantities are at hand, and the computation of the center of gravity proves to be a simple matter.

From what has been said the average velocity will be given by

$$u_{av} = \frac{N_b' A u_2 + L u_1}{N_b' A + L} \qquad (5)$$

where

- u_{av} = average velocity of flow through shell, ft./sec.;
- u_1 = velocity parallel to tubes, ft./sec.;
- u_2 = velocity perpendicular to tubes, ft./sec.;
- L = total distance parallel to tubes, or length of exchanger between inlet and outlet, inches;
- A = distance traveled perpendicular to tubes, or distance from center of gravity of upper to center of gravity of lower segment, inches;
- N_b' = one less than the number of baffles.

When all the constants for a particular set-up are once computed, they never have to be repeated.

An example will be given. For the tube bundle with five-eighths inch tubes on

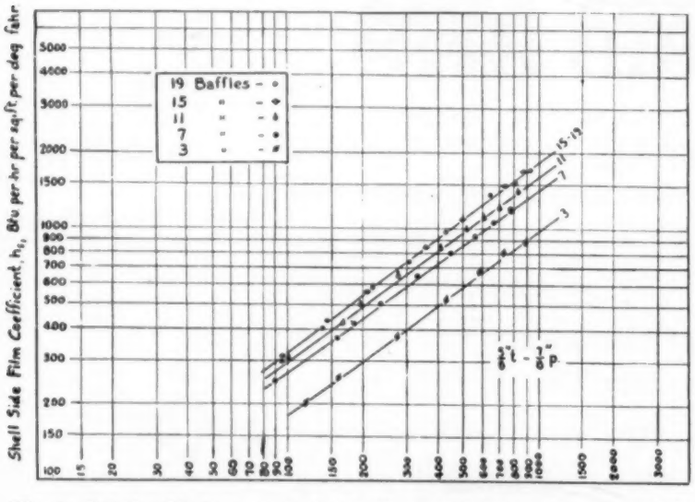

Fig. 5—Relationship between shell-side film coefficient and average weight velocity through shell, G, pounds per hour per square foot

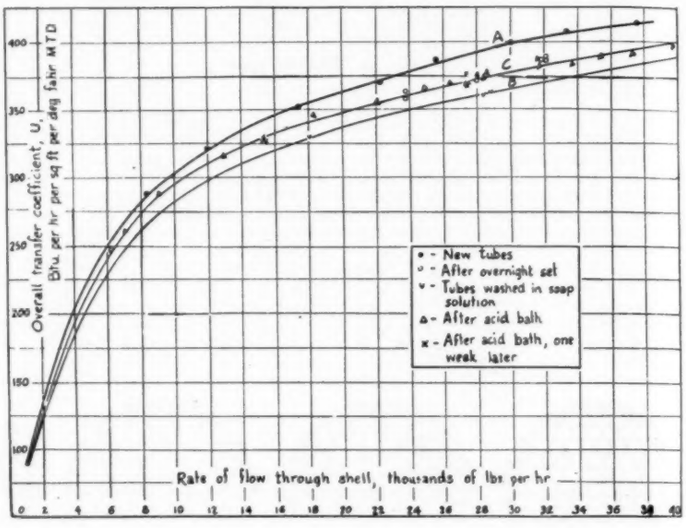
Overall transfer coefficient, U, Btu per hr per sq ft per deg fahr MTD
Rate of flow through shell, thousands of lbs per hr
• - New tubes
○ - After overnight set
▽ - Tubes washed in soap solution
△ - After acid bath
× - After acid bath, one week later

Fig. 6—Effect of tube cleanliness on heat transfer

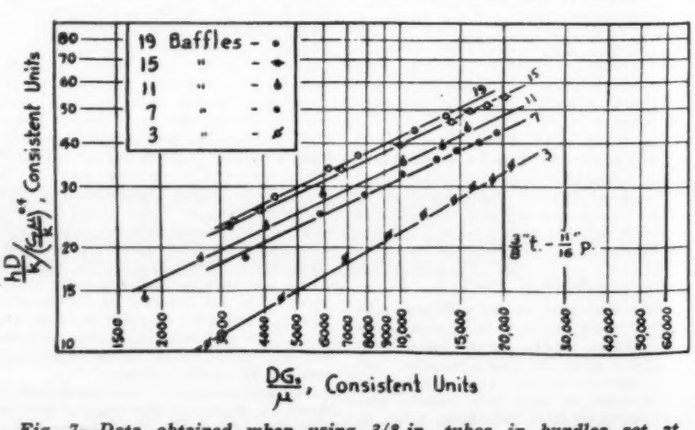

Fig. 7—Data obtained when using 3/8-in. tubes in bundles set at 11/16-in. pitch

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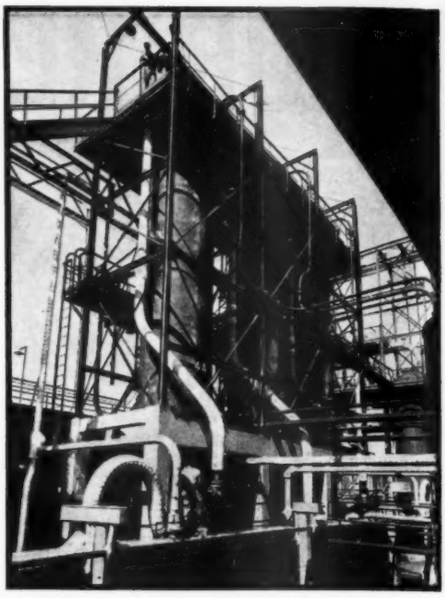
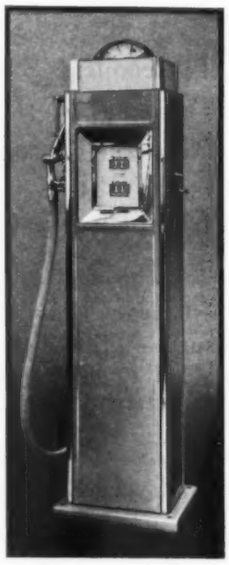


REFINERS HAILED *the "passing of the gas funnel" as an important step in their progress towards more economical distribution.*

IN 1910: A bucket and funnel at the curb; a small storage container in the background—that was the equipment which dispensed a refinery's gasoline to the motorist in the early days of the automobile. When cars became more numerous, refineries found it necessary to meet the ever mounting demand and economical distribution became a major problem. Small storage containers required frequent refilling and quickly pyramided distribution costs.

In 1908, Gilbert & Barker recognized the refinery's plight, saw a tremendous potential market for gasoline and lubricating oil dispensing equipment. Forty years' experience in handling gasoline (they had manufactured the Gas Machine since 1865) furnished a valuable background. With this knowledge and their vast resources they were able to contribute largely to the solution of the problem.

Gilbert & Barker placed its first pump on the market in 1910. It was a detachable type, to be attached to an underground tank. Compact, efficient, trouble-free—it transferred gasoline quickly to the automobile. In 1911, they followed with a curb pump—a vast improvement over its predecessor since it was stationary. Some of these original pumps are still in use. Tank development went hand in hand with pump improvement and in two years Gilbert & Barker had attained a leading position in furnishing needed co-operation to the solving of refineries' marketing problems.



IN 1922: Gilbert & Barker introduced the famous Model T-65 pump—the most universally used gasoline pump in the world.

IN 1926: Gilbert & Barker came forward with one of the most valuable contributions in the history of the Oil Industry—"Nultra" glass for bowls of visible pumps. The advent of the visible pump a few years previously created one of the industry's greatest problems—discoloration of gasoline due to the effect of the rays of the sun. The new "Nultra" glass filtered out the destructive rays to such an extent that gasoline in visible pumps retained its original color throughout the ordinary time of storage in the visible glass bowl.

1935 CALCO-METER PUMP. *It thinks for the dealer, increases gallonage for the refinery.*

IN 1935: A far cry from the 1910 pump is the 1935 Model 70 Calco-Meter Pump. An automatic computing pump, it registers gallons and cents on the dial. No mental arithmetic is required.

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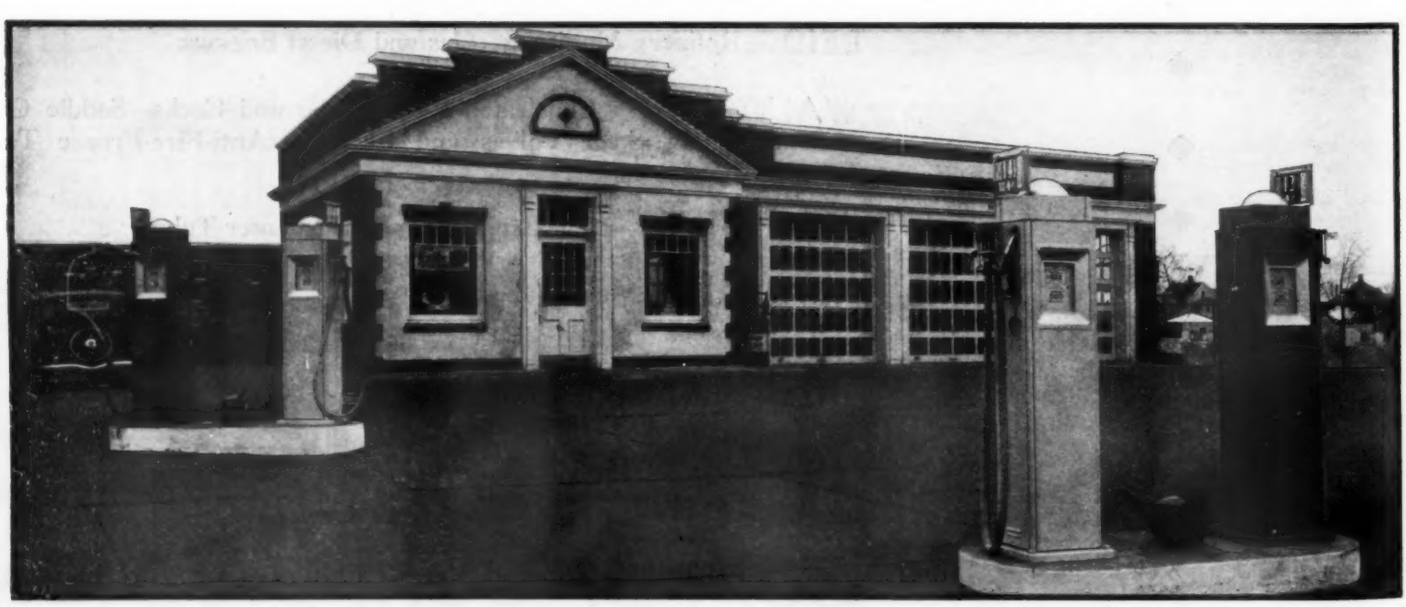
The New CALCO-METER is already journeying over the world to join the pumps that have gone before it. It is the climaxing development in a quarter of a century of service to the motorists, the service stations and the refineries of the world.



IT TOOK TWENTY-FIVE YEARS TO BUILD THIS STATION. *This service station of today reflects the quarter-of-a-century progress of gasoline dispensing. The pumps are the new Gilbert & Barker* CALCO-METERS.

(THIS IS THE FIFTH OF A SERIES OF ADVERTISEMENTS ON THE HISTORY AND GROWTH OF GILBERT AND BARKER MANUFACTURING COMPANY, SPRINGFIELD, MASS.)

seven-eighths inch pitch and 11 baffles, average velocity was found thus:

Area of segment = 8.9 square inches.
Length of chord = 5⅝ inches.

Then the distance from the center of the circle to the center of gravity will be

$$\frac{c^3}{12a} = \frac{(5.625)^3}{12 \times 8.9} = 1.665''$$

hence

A = 2 × 1.665 = 3.33 inches.
L = 48¾ inches.
$N_b' = 11 - 1 = 10$.

then

$$u_{av} = \frac{(10 \times 3.33)\, u_2 + (48.75)\, u_1}{33.3 + 48.75}$$

$$= 0.406\, u_2 + 0.594\, u_1$$

A plot of the shell side coefficient against the average weight velocity for this bundle is shown by Figure 5. The consistency of the curves indicates that the given method of computing velocity is satisfactory.

Cleanliness Standard

Something should be said at this point in regard to the establishment of a cleanliness standard. A bundle was assembled and placed in the shell one afternoon and runs were made over a wide range and several points were checked. The curve obtained from these runs is shown by Curve A, Figure 6. The next morning an attempt was made to check these runs, but the overall transfer coefficient in every run fell appreciably below the curve previously obtained. These points are shown plotted in Figure 6. At first it was thought that this condition might be due to a fine deposit of pipe compound coming from the newly assembled pipes; and so the tube bundle was removed and washed in a soap solution. Upon replacing the bundle and taking readings, the overall coefficient became still lower, as shown by Curve B. The bundle was next washed well in a weak solution of hydrochloric acid and the tubes were swabbed. The runs then gave values of overall coefficient in line with those obtained after setting overnight, and Curve C was obtained. The bundle was removed, and one week later it was given an acid bath and replaced in the shell. The values of overall coefficient again fell on Curve C, showing that a weak acid bath was necessary to establish a cleanliness standard. After the "overnight set," it was impossible to obtain values of overall coefficient as high as those obtained with the new tubes. This same condition was encountered with each of the 10 bundles assembled. This seems to indicate that a new tube is not a good standard of cleanliness, and that the standard should be the cleanliness after about a 24-hour set.

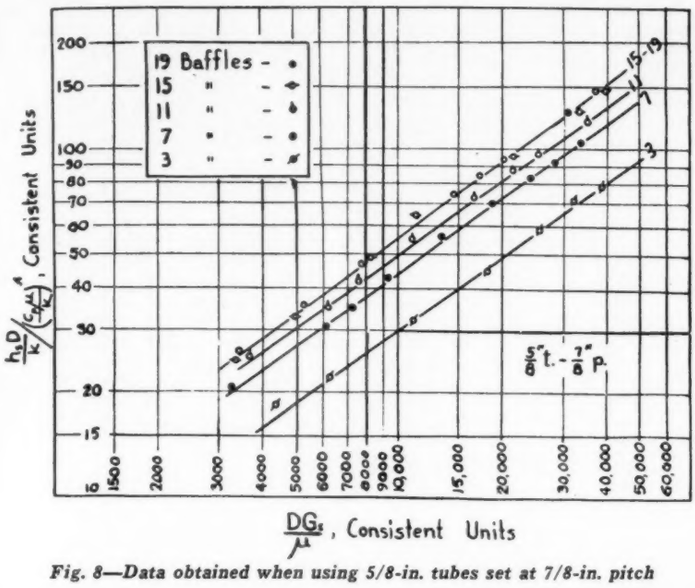


Fig. 8—Data obtained when using 5/8-in. tubes set at 7/8-in. pitch

Dimensionless Groups

In correlating these data it was desired, if possible, to end with dimensionless groups; but on the shell side of a baffled heat exchanger the complications make it extremely difficult, if not impossible to correlate experimental data entirely with dimensionless groups. In these results it was found to be impractical to end with an entirely dimensionless relation.

The various factors affecting the shell side film coefficient are the fluid viscosity, conductivity, and specific heat, weight velocity, tube diameter, tube pitch, shell diameter and length, and number of baffles. The general equation for turbulent flow inside pipes was developed by Nusselt, and it groups the various variables in dimensionless groups, giving the following power function:

$$\frac{h\,D}{k} = a \left(\frac{D\,G}{\mu}\right)^n \left(\frac{c_p\,\mu}{k}\right)^m \left(\frac{D}{L}\right)^o \quad (6)$$

The results herein presented were correlated using these dimensionless groups and the additional groups involving the other variables. The final correlation gave a relation of the form,

$$\frac{h_s D}{k} = a \left(\frac{D\,G_s}{\mu}\right)^n \left(\frac{c_p\,\mu}{k}\right)^m \left(\frac{d_s}{L} \cdot N_b\right)^p \left(\frac{P^r}{D^s}\right) \quad (7)$$

where

h_s = shell film coefficient, B.t.u. per hour per square foot per degree Fahrenheit m.t.d.;
D = outside tube diameter, feet;
$G_s = u_{av}\,\rho$ = average weight velocity, pound per hour per square foot;
P = tube pitch, feet;
d_s = diameter of shell, feet;
L = distance between inlet and outlet, feet;
N_b = number of baffles;
c_p, μ, k as before, evaluated at average fluid temperature;
a, n, m, p, r and s are constants.

The group involving the baffles takes care of the number of baffles, shell diameter, and shell length, all of which are closely related and tied together. It was impossible to keep the last group dimensionless, since the exponents on P and D were found to be different for a satisfactory correlation.

Prandtl's number, $\left(\frac{c_p\,\mu}{k}\right)$, was arbitrarily assigned an exponent of 0.4, due to lack of data which would enable its calculation. The fluid used throughout the tests was water, and the range of viscosity and conductivity was not sufficient to plot curves and analytically evaluate Prandtl's group. This exponent is the most common one used in heat transfer calculations inside tubes, and it

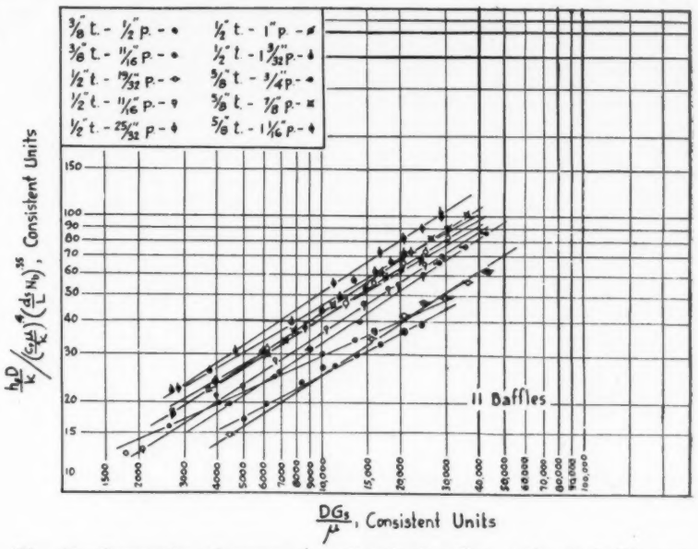


Fig. 10—Composite of curves for all tube bundles at the 11 baffle condition with effect of baffles eliminated

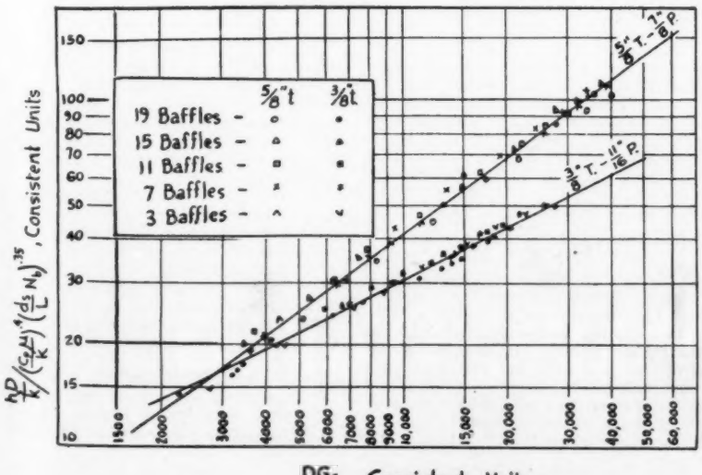


Fig. 9—Correlation of data on two arrangements and sizes of tube bundles

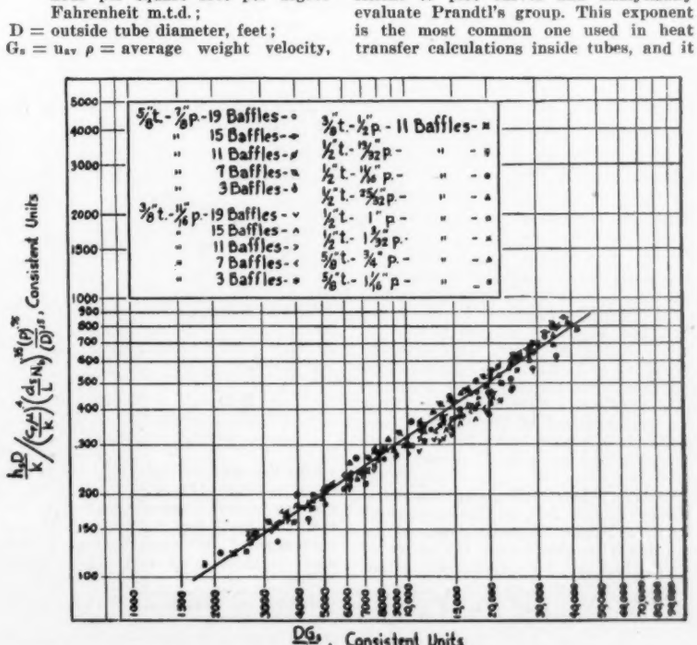

$\frac{h_s D}{k}/\left(\frac{c_p \mu}{k}\right)^{\frac{1}{3}}\left(\frac{d_s}{L N_b}\right)^{.35}\left(\frac{P}{D}\right)^{.25}$, Consistent Units
$\frac{DG_s}{\mu}$, Consistent Units

Fig. 11—Final correlation of data on 18 different arrangements of 10 tube bundles

was assumed that it did not change on the shell side.

In order to find the effect of the baffles and to evaluate the exponent of the group containing the number of baffles, a particular bundle was used, so as to eliminate the effect of tube size and pitch. For the bundles with five-eighths inch tubes and seven-eighths inch pitch, curves were plotted with $y = \frac{\left(\frac{h_s D}{k}\right)}{\left(\frac{c_p \mu}{k}\right)^{0.4}}$ vs. $\frac{D G_s}{\mu}$.

These curves are shown by Figure 8. A similar set of curves was plotted for the bundle made of three-eighths inch tubes on eleven-sixteenths inch pitch, and these are shown by Figure 7.

In order to bring all the points within a narrow band, the group $\left(\frac{d_s}{L} \cdot N_b\right)$ was evaluated for each baffle condition, and an exponent was determined so that on dividing the ordinates by the group with this exponent, all the points fell within a narrow range. This exponent was found to be 0.35. The correlation for two tube bundles is shown by Figure 9. Each bundle will have a separate curve, due to the effect of the diameter and pitch, the tendency being for the larger tube diameter to give a steeper slope curve.

The exponent of this group was determined from the data on the five-eighths inch tube bundle. The consistency of the resulting plot shows that the effect of the baffling can be satisfactorily eliminated by the group $\left(\frac{d_s}{L} \cdot N_b\right)$ with the exponent mentioned.

The problem now consists in eliminating the effect of the diameter and pitch. This proved to be a very difficult problem, due to the variation in slope of the curves, but a reasonable solution was obtained. Figure 10 shows the curves for all the tube bundles at the 11-baffle condition with the effect of the baffles eliminated. As previously mentioned, the larger diameter tubes give the steeper slope curves. On the other hand, the tendency is for the larger pitch bundles to give flatter curves.

At first, it was attempted to correlate the various tube diameters and pitches by means of the ratio of pitch to diameter. On investigation it turned out that this ratio would bring the data for any particular tube diameter into a narrow range, but the data for different diameters still had a wide spread. This meant that the tube diameter should enter the equation again. The final form for this group was $\left(\frac{P}{D}\right)^r \cdot D^t = \frac{P^r}{D^{r-t}} = \left(\frac{P^r}{D^s}\right)$ in which $r = 0.95$ and $s = 0.15$

The final correlation, including 18 different setups on 10-tube bundles, is shown by Figure 11. The equation of the average line is,

$$\frac{h_s D}{k} = 0.73 \left(\frac{D G_s}{\mu}\right)^{0.95} \left(\frac{c_p \mu}{k}\right)^{0.4} \left(\frac{d_s}{L} \cdot N_b\right)^{0.35} \cdot \left(\frac{P^{0.95}}{D^{0.35}}\right) \quad \ldots (8)$$

where the symbols and units are as given in equation (7). This relation should give an accurate approximation of the shell side coefficient for any baffled heat exchanger of the same general pattern used in these tests and using cut-out baffles.

Several of the points deviated somewhat from the average curve, and a probable explanation is offered. The pattern of each bundle cannot be brought into the equation, yet its effect is present. By examining the baffle it is seen that in some cases there is an appreciable clearance between the outside tubes of the bundle and the shell. For the bundles with a small pitch this area is an appreciable percentage of the total free area, yet the flow through this clearance transfers very little heat. This means that at high rates of flow the heat transferred will be lower than would be expected from the tendency at the low rates. The points lying off the average curve were plotted from data at high rates of flow around tube bundles with an appreciable clearance. Also, there is the probability of experimental errors being present, and the possibility that the cleanliness of the tubes was not the same for every test.

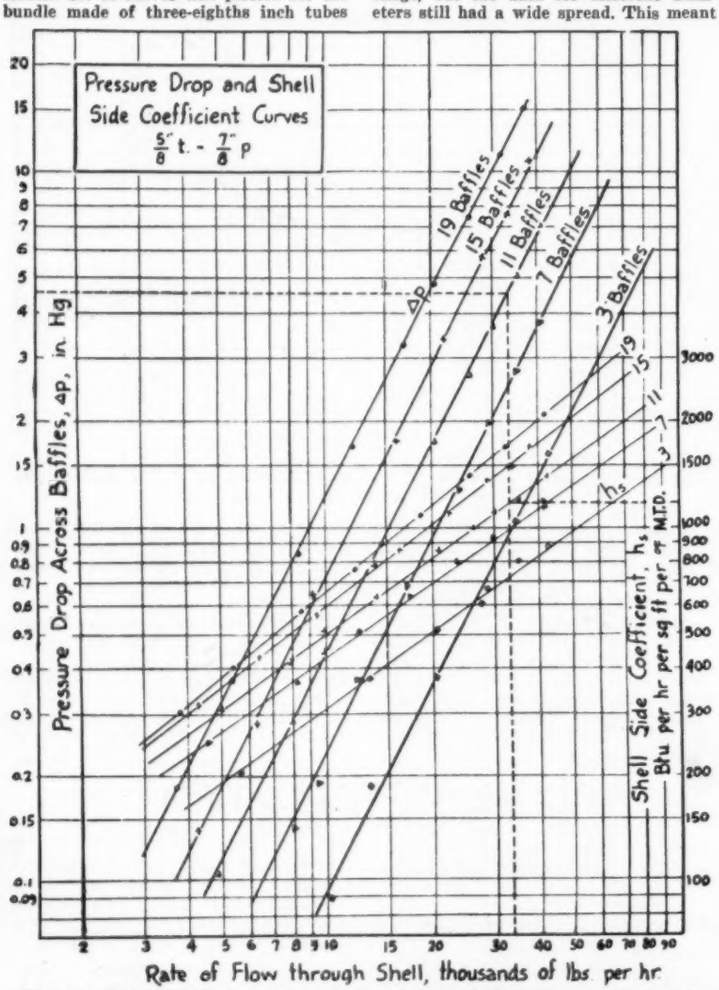

Pressure Drop and Shell Side Coefficient Curves
5/8" t. - 7/8" p
Pressure Drop Across Baffles, Δp, in. Hg.
Shell Side Coefficient, hs, Btu per hr per sq ft per °F. M.E.D.
19 Baffles
15 Baffles
11 Baffles
7 Baffles
3 Baffles
Δp
hs
Rate of Flow through Shell, thousands of lbs per hr.

Fig. 12—Relationship between pressure drop and shell side coefficient for 5/8-in. tubes set at 7/8-in. pitch

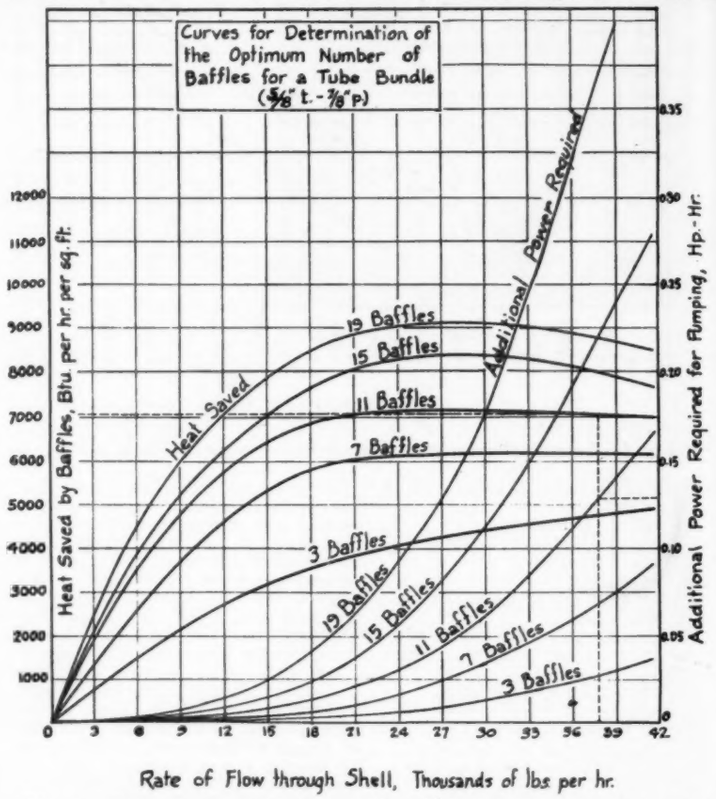

Curves for Determination of the Optimum Number of Baffles for a Tube Bundle (5/8" t. - 7/8" p)
Heat Saved by Baffles, Btu. per hr per sq. ft.
Additional Power Required for Pumping, Hp.-Hr.
Heat Saved
Additional Power Required
19 Baffles
15 Baffles
11 Baffles
7 Baffles
3 Baffles
Rate of Flow through Shell, Thousands of lbs per hr.

Fig. 13—General curves for bundle with 5/8-in. tubes set at 7/8-in. pitch plotted against rate of flow through bundle

Pressure Drop

In this report no attempt is made to analyze the pressure drop across the baffles, but the results are presented as a comparison with the rates of heat transfer. A detail analysis of the pressure drop across heat exchangers equipped with cut-out baffles was reported by Short and Stack[2] in 1934. Since this paper is intended to cover the shell side of the exchanger, a plot is shown by Figure 12 giving the relation between pressure drop and shell side coefficient for the bundle of five-eighths inch tubes and seven-eighths inch pitch at different rates of flow through the shell, rather than giving the relation between overall coefficient and pressure drop. At any given rate of flow the pressure drop for a particular baffle setting may be found, as well as the film coefficient on the shell side for the same point.

In operating heat exchangers it is not the highest possible heat transfer coefficient that is desired, but rather an optimum balance between heat saved and pumping costs. In a baffled heat exchanger there is an economical number of baffles for a given bundle, which is determined by the value of heat and cost of pumping. Figure 13 shows the general curves for the tube bundle with five-eighths inch tubes on a seven-eighths inch pitch plotted against rate of flow through the shell. These curves will not apply to any other tube bundle, but they show the effect of baffling. These curves apply for any value of heat and power.

To determine the economical choice for a particular condition, additional curves must be plotted from these curves, showing value of heat saved and additional cost of pumping plotted against number of baffles. The point giving the maximum total savings will give the number of baffles to use for the specific case. In plotting the new curves the value of heat, cost of power, area of tubes in bundle, number of hours of operation, and efficiencies must be known.

The 9 and 11-baffle conditions gave a practically constant value of heat saved after reaching a maximum value. This property is very desirable, since it eliminates this variable over a wide range of operation.

Conclusions

The results of this investigation lead to the following conclusions:

1. The average velocity around cut-out baffles on the shell side of a heat exchanger is determined by the components along and perpendicular to the tubes;
2. Data on heat transfer on the shell side of a baffled heat exchanger may be correlated into a practically dimensionless relation;
3. Baffling materially increases the rate of heat transfer on the shell side of a heat exchanger up to a point of maximum return;
4. An increase in tube spacing increases the shell side coefficient of a baffled heat exchanger;
5. The fluid friction losses determine the economical amount of baffling.

Acknowledgments

This research was sponsored by the department of mechanical engineering and the bureau of engineering research at the University of Texas, Austin, Tex., and was done in conjunction with and under the direction of Prof. B. E. Short, to whom the author is greatly indebted for suggestions and ideas.

[2] Short and Stack. "Effect of Diameter, Spacing, etc., on Pressure Drop Around Tubes of a Shell Type Heat Exchanger." The Oil and Gas Journal, v. 32, No. 51, p. 115.

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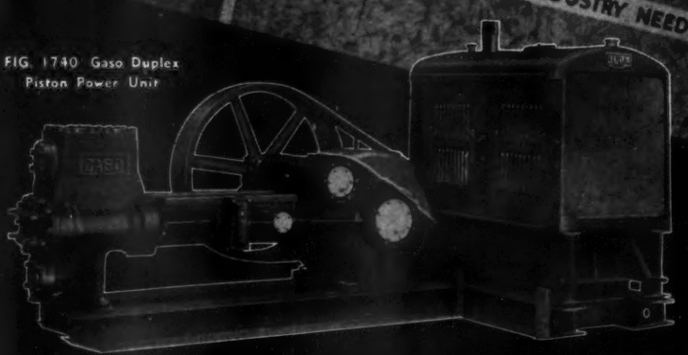
FIG. 1740 Gaso Duplex Piston Power Unit



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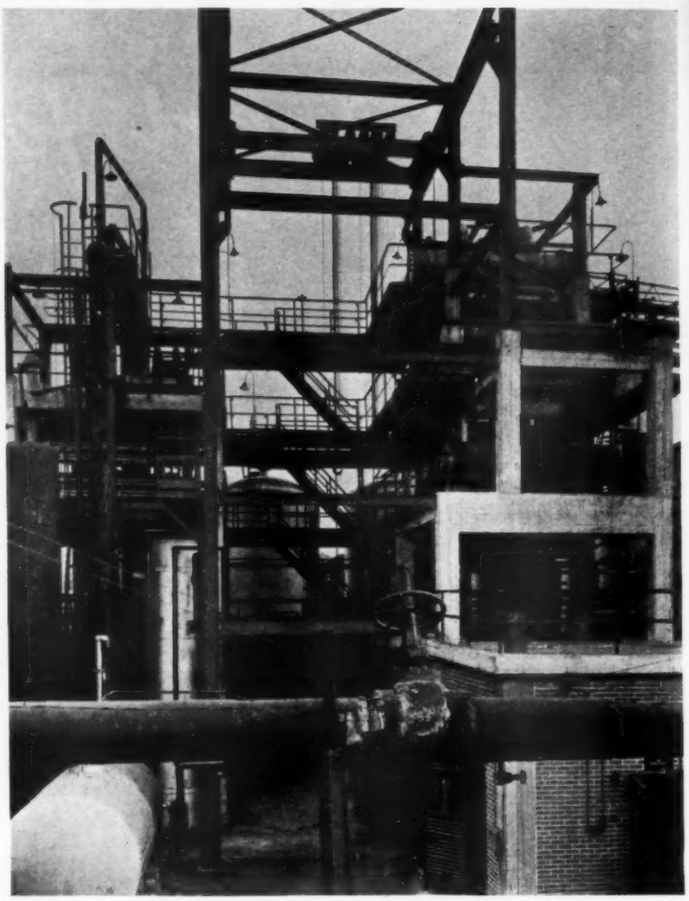
Atlantic Refining Uses Mixture of Acetone-Benzol for Dewaxing

By W. A. MYERS
Atlantic Refining Co.*



Distillation units as part of acetone benzol dewaxing plant at the Philadelphia refinery of the Atlantic Refining Co.

In 1934 a plant for dewaxing oils by the Acetone-Benzol process was constructed in Philadelphia by The Atlantic Refining Co. as licensee of the Texaco Development Corp. The process of dewaxing oils using a mixture of Acetone and Benzol as a solvent has been previously discussed by Francis X. Govers and G. R. Bryant in a paper presented before the refining division of the American Petroleum Institute in Tulsa, May 1933. The process consists in mixing the wax bearing oil with the solvent, chilling this mixture to the desired operating temperature and passing the mixture to a filter. The wax free oil containing most of the solvent goes through the filter medium and the wax with some solvent remains on the filter leaf. The solvent is then recovered from both the wax cake and the pressed oil for reuse.

The process can be used on oils of the pressable wax distillate variety or on heavier oils which have heretofore been handled in either the cold settling or centrifuging operation. The process differs from the above mentioned methods in two important respects. The oil solvent mixture can be continuously chilled at a fairly high rate without jeopardizing the results in contradistinction to the centrifuge method which requires very slow cooling. The differential between the chilling temperature and the pourpoint of the finished oil is small thus the necessity for cooling the mixture to very low temperatures in order to make oils of moderate pour is eliminated by this combination solvent.

The plant which has been installed in Philadelphia embraces several new features in design and operation. The attached Figure 1 shows a flow diagram of the process in use at this plant. Beginning at the upper left hand corner the oil is taken from storage with a pump and delivered through a recording flow controller to the mixers. The solvent is handled in a similar fashion. The recording flow controllers thus set the oil solvent ratio for the operation. The two materials are pumped through the "knothole type" mixer. From here the mix travels through a "scraper type" exchanger, giving up its heat to the outgoing pressed oil.

Means for Chilling

The final chilling is accomplished in a second scraper type unit using direct expansion of ammonia. The solvent oil mix leaves these exchangers at a definite controlled temperature and is delivered into the dewaxing mix surge tank which is maintained under a pressure of 40 pounds by compressed flue gas. The mixture flows under this pressure to the filters. The dewaxed oil leaving the filters goes through a surge tank from which it is pumped through the annular space in the previously mentioned exchangers and thence to the solvent recovery system. The wax cake either before or after washing with fresh solvent is discharged from the leaves of the filter by means of a slight flue gas backpressure and is thence carried to a slack wax mix surge tank by means of a screw conveyor. From here the material is pumped through the wash solvent exchanger and thence to the solvent recovery system. Any water present in the original charge appears in the wax cake and may be separated by decantation after passing through the wash solvent exchanger.

Solvent Recovery

The two solvent recovery units, one for slack wax and one for dewaxed oil, are similar except for size. The mixture is charged to suitable exchangers (not shown) obtaining heat from the outgoing materials and thence to the evaporator system where the bulk of the solvent is removed by the application of heat in steam coils. The residual material containing a small amount of solvent then flows down through a stripper tower counter-current to a rising stream of superheated steam which removes the balance of the solvent.

The solvent recovered from the slack wax cake contains whatever water entered the system with the wax bearing oil, unless this was removed as mentioned above. This solvent may be dried by bubbling up through a container filled with soda ash solution before it is reused. The strippings removed from the oil and wax consists of a mixture of solvent and water. These materials pass through a decanter. The solvent layer of this mixture may also pass through the drier. The soda ash in the drier is reconcentrated by evaporation of water. Since acetone is soluble in water the water layer from the strippings and the water recovered from the drier both contain acetone. This acetone is recovered from the water by means of a small acetone water still and fractionating column. The pure acetone taken overhead is returned to the system. The denuded water along with the open steam used for heating is discharged to the sewer.

The filters used in this plant are of the rotating leaf pressure type. The plant is equipped with four of these filters, having an effective surface of about 800 square feet each. The leaves are made up of four quadrants which are held to the central shaft by clip angles bolted to tie rods running out from the shaft. The leaves are covered with XX chain cloth (199 CH). The rotation of the leaves assures an even cake over the whole surface. The filtrate passes through the cloth into the leaf and thence to the hollow central shaft which contains a separate channel for each quadrant. Thus if a leak develops at any one point, that particular quadrant can be cut out and the operation of the filter continued on the other three quadrants. The filters are insulated with admits solvent oil mix to the filter for a definite period of time during which the filtration takes place. He then reverses the valves and blows back the oil solvent mix which remains in the shell of the filter. The cake on the leaves may then be dried by pressure of the flue gas in the shell if no washing is to be done.

If it is desirable to recover the maximum quantity of dewaxed oil from the cork and hence the operating room may be kept at a comfortable temperature.

The filters are operated on a time cycle, based on experience. The operator original charge oil, the operator fills the filter with previously cooled wash solvent and washes the cake for another definite period of time. The wash solvent is then blown back to a separate tank and the cake dried with flue gas. The wax is then removed from the leaves by a slight flue gas back pressure on the inside of the filter sectors. This cake falls to the bottom of the filter into a screw conveyor which delivers the material to the slack wax surge tank. In passing through the screw conveyor the cake is so broken up that it becomes a pumpable slurry.

The evaporators for recovering the solvent are of a novel design. They consist in a horizontal cylindrical shell containing three flat shallow pans placed one above the other. In each pan there are two rows of tubes. Steam is delivered to the far end of these tubes by means of a small inner tube leading from the steam header. The steam condensate returns through the outer tube to the condensate header. The liquid charge flows into the top pan and across the steam tubes, then by means of suitable down pipes the remaining liquid is delivered to the opposite side of the second pan and flows across the steam tubes there. By means of this arrangement a low liquid head is maintained on the boiling material. This combined with a favorable cross flow velocity gives high heat transfer rates.

The use of steam as the heating means for recovering the solvent, possesses three

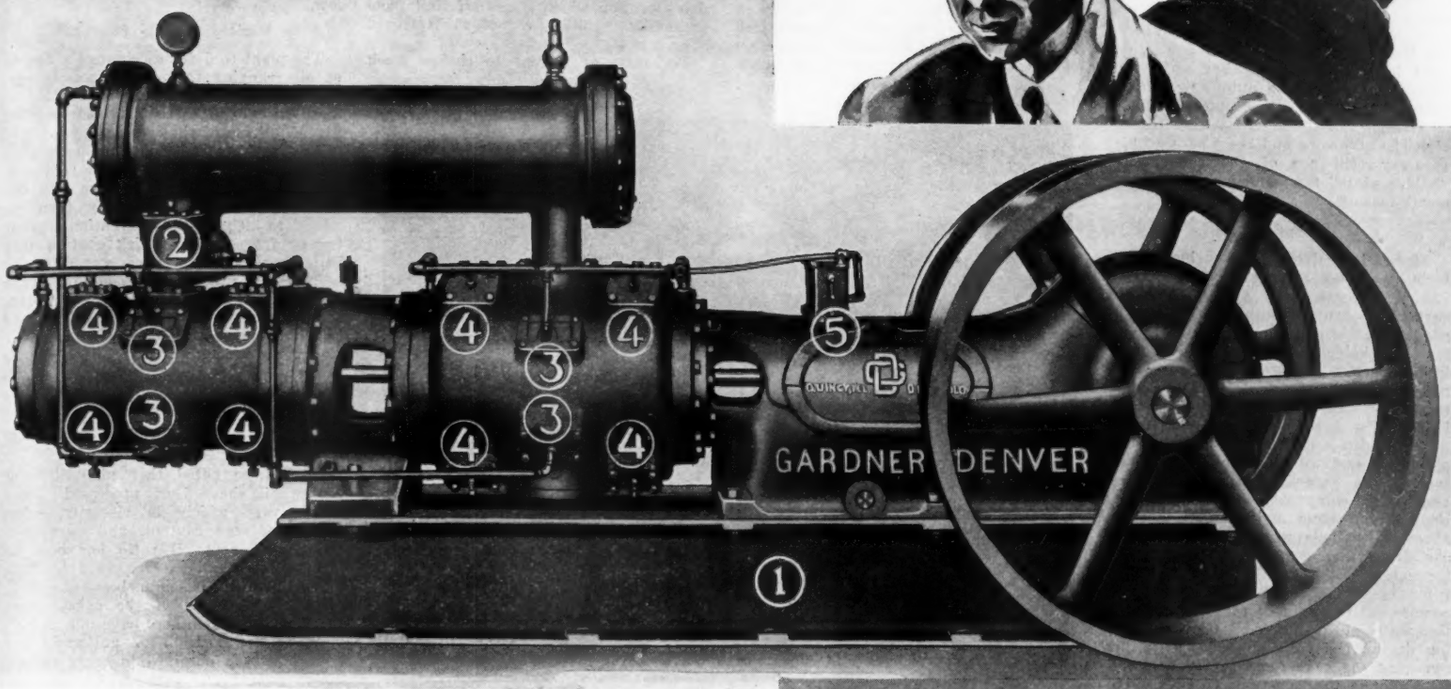
TABLE 1.—TYPICAL DATA ON ACETONE-BENZOL DEWAXING

Charge stock—	1	2	3	4	5	6	7	8	9
Inspection:									
Gr. °A.P.I.	26.3	26 4	23.3	23.9	23.7	23.1	26 6	22 7	21.5
Vis/210°F.	....	....	....	50	....	56	58	....	68
Vis/100°F.	89	125	294	320	344	378	....	552	825
Color N.P.A.	2	2	3¼	3¼	3¾	3¼	2¾ Dil.	4	5½
Pour °F.	30	25	25	30	40	50	110	55	65
Treatment:									
Solvent ratio	2.2:1	2.5:1	2.25:1	2.5:1	2.5:1	3.0:1	4.0:1	2.25:1	3:1
Final chill. tem.°F	−20	−30	−10	−20	−10	−15	−10	−15	−30
Wash ratio	....	....	0.4:1	....	0.4:1	....	....	0.4:1	....
Pressed oil:									
Gr. °A.P.I.	25.9	25.5	23.1	23.3	23 7	22 4	22 3	22 4	21.0
Vis/210°F.	....	....	....	50	50	....	58	60	....
Vis/100°F.	94	138	346	350	337	409	....	596	825
Color N.P.A.	2½	2	3¾	3½	4	3½	3½ Dil.	4¾	5¾
Pour °F.	−10	−20	−15	−10	−5	−15	−5	−15	−10 to −15
Wax cake:									
Chill Temp.	−20	−30	−10	−20	−10	−15	−10	−15	−30
Pour point	−10	−20	−10	−10	−5	−15	−5	−10	−10 to −15
Differential	10	10	0	10	5	0	5	5	15–20*

*Chemical Engineer in charge of design.

* Short period of operation. Results not necessarily representative.

LOOK INSIDE



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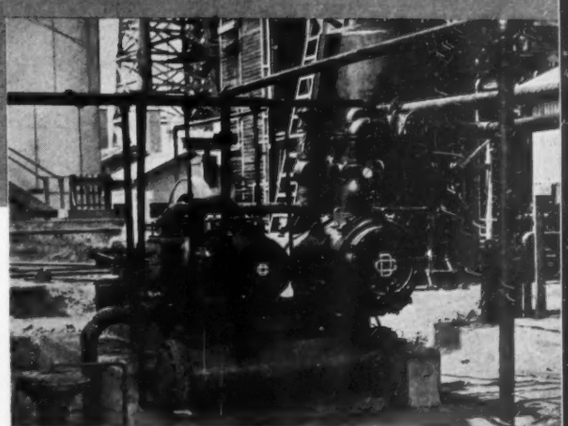

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advantages over the use of direct fire. First, the fire hazard is practically eliminated from the plant. In addition to this the danger of darkening the oil due to excessively high film temperatures is eliminated. The use of steam heating also cuts down the labor involved in operating the plant, since the shut downs, due to a loss of feed or similar unforeseen circumstances become automatic and require no multiplicity of operations such as pulling the fire, recirculating the oil, etc. The strippers and the acetone water recovery still are of the conventional "bubble plate" type and embrace no unusual features.

Solvent Losses

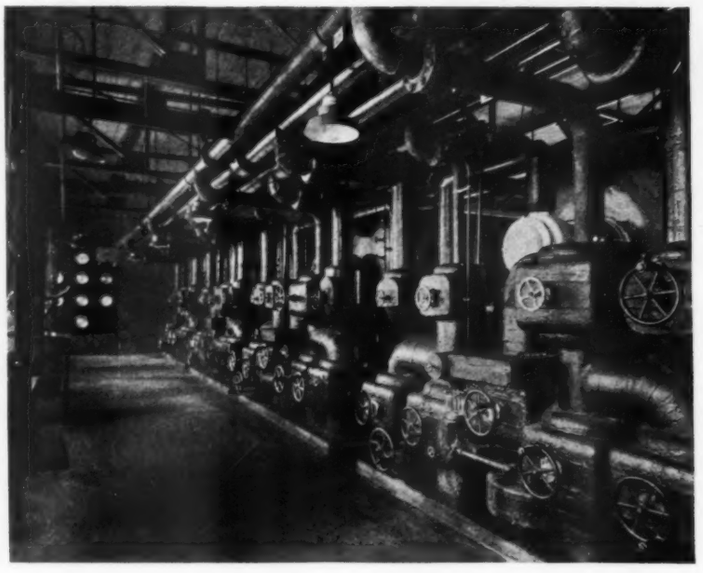
Since the solvent is a valuable material and since acetone is volatile (B.P. 135°F.) a gas tight system is necessary. The plant is equipped with a flue gas generating system and a 10,000 cubic foot gas holder. Refinery gas is burned in the generator and the flue gas evolved passes through a dehydrator to remove the water vapor and thence to the gas holder. The gas in the holder is maintained under a pressure of a few inches of water and all the tanks containing solvent are vented to this holder. A two stage compressor takes gas from the holder system and compresses it to about 40 pounds per square inch. The gas from this compressor then passes through a chiller and is delivered at the filter operating temperature. This cold compressed gas is used for blowing back the material in the shell of the filter, for drying the cake on the leaves, for removing the cake from the leaves, and for holding the constant feed pressure on the dewaxing mix surge tank and the wash solvent surge tank. The gas vented from the filter is returned to the holder system; thus a closed system is maintained and the solvent vapors evolved are condensed in the oil used as a seal for the holder. A periodic distillation of this oil in the pressed oil system effects the recovery of the solvent for reuse.

Solvent a Mixture

The solvent used in the acetone-benzol process is in reality a mixture of acetone, benzol and toluol. The benzol is used as a solvent for the oil. Toluol is equally suitable for this purpose. The acetone acts as a precipitant for the wax and as an anti-freeze for the benzol. Toluol is about equally effective as an anti-freeze for the benzol. The composition of the solvent is adjusted to suit particular conditions with these factors in mind, thus the acetone concentration must be such that the wax is insoluble at the operating temperature but must not be so high that paraffinic oil becomes insoluble at the operating temperature. The combined acetone and toluol concentration must be such that benzol crystalls do not form at the operating temperature. In actual practice the acetone fraction varies from 25 to 35 per cent and the toluol from 12 to 25 per cent, the benzol making up the remainder. The more paraffinic stocks require the lower acetone fractions; the lower operating temperatures require the higher combined acetone and toluol fractions. The composition of the solvent may be changed for various stocks since the simple distillation system used allows the segregation of the low boiling "acetone rich" fraction which comes off first from the higher boiling fractions removed later.

The ratio of solvent to charge stock varies from two parts of solvent per part of stock to four parts of solvent per part of stock, depending on the wax concentration and the viscosity of the stock. The wash solvent varies from nothing to two parts of stock, depending on the relative economies of the washing process. When the stock has a premium value or a limited supply is available, washing is desirable.

The oil solvent mix is chilled to a temperature which is usually about 5° below the desired pourpoint. This is sufficient to produce properly dewaxed oil from most stocks and thus the refrigeration requirements for this process per volume of total charge are comparatively low.



Operating end of filters

Variety of Oils Charged

The plant to date has charged a variety of oils ranging from low viscosity neutral (100 Saybolt seconds at 100°F.) to distillates of 70 seconds Saybolt at 210°F. Some of these oils were obtained from East Texas crude and hence have a high wax content (of the order of 20%). Others were made from wax distillate which had previously been dewaxed to 30 pour, by conventional pressing or from crudes which contain very little wax. In no case has any difficulty been met in producing oils of lower than zero pour. It is planned to use this plant for dewaxing more viscous distillates and residuals as the need arises.

The plant has a rated capacity of five hundred 50-gallon barrels of charge oil per day with a solvent-oil ratio of 4 to 1 in the mix, and 1½ to 1 for wash. Table 1 shows some typical results obtained in this plant to date.

It will be noted that nine different charge oils have been processed. These stocks vary widely in viscosity, color, pourpoint, wax content, and paraffinicity. The solvent oil ratio has been as low as 2.2:1 and as high as 4:1. Chilling temperature has been between –10°F. and –30°F. Some of the cakes have been washed and others have not. A high yield of dewaxed oil of uniformly low pour has been obtained in every case.

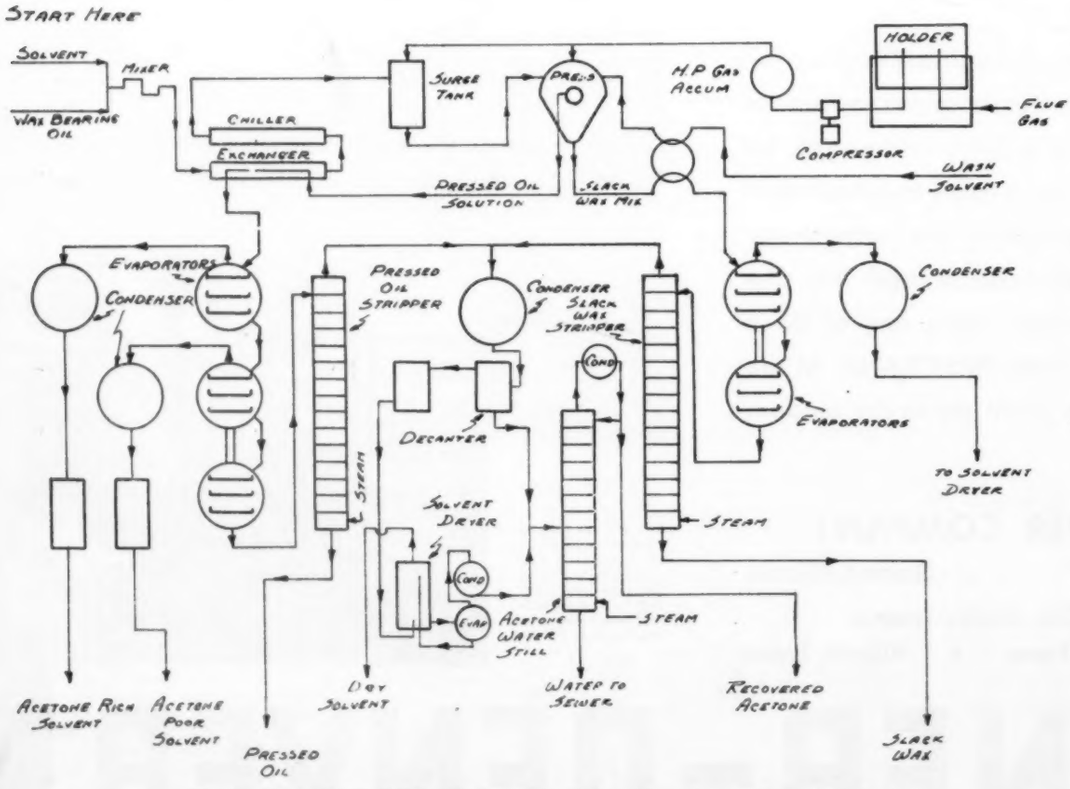


Fig. 1—Flow sheet of Atlantic Refining Co.'s acetone-benzol dewaxing plant

Agriculture Consumes Large Volume of Oil

Already some 6,000,000 motor vehicles and 1,000,000 tractors, consuming more than 2,000,000,000 gallons of petroleum fuels annually, are used on American farms and ranches. There are more than 534,000 motor vehicles, above 70,000 tractors, on farms and ranches of Texas, Oklahoma, New Mexico and Arizona.

Farm motor vehicle consumption of about one-fourth of the nation's motor fuel supply is augmented by demands for fuels and lubricants created by some 300,000 farm lighting plants, 5,000 Diesel motors, uncounted numbers of stationary engines, pumping plants, motorized farm machine shops, washing machine engines, sawmills, etc. Other petroleum products are used in enormous quantities in farm heating plants, refrigeration and milk cooling units, incubators, and other devices.

Today such farm machinery as binders, reapers, cultivators, harrows, and the like consume something like 76,000 tons of grease every year. There are other less spectacular uses. Harness oil and hoof oil still are in demand on farm and ranch. Herd oil and hog oil are used to discourage pests. In fact, petroleum insecticides are growing in use for promotion of healthy crops in farm fields and orchards, and healthy families in farm homes.

Kerosene still provides the illuminant for some farm and ranch lanterns, gasoline for others. Kerosene fuels the cook stoves, the dinner lamp, and has even been promoted to such tasks as fueling the farm home refrigerator, the milk cooler, and other refrigeration units. In this field, however, liquefied petroleum gases are usurping the place of kerosene for use in homes beyond the reach of electric power lines. Packed in steel drums containing a supply sufficient for as long as six months, they not only fuel the cook stove and the refrigerator, but also light the home.

Light oil finds a use for lubricating light machinery—the sewing machine, for instance. Petroleum jellies, creams, and ointments appear among the cosmetics on the dressing table. Black liquorice has given place to colorless oils in the medicine cabinet. Many a worker is finding the Indian's advice about using oil for muscular aches and pains still decidedly "good medicine."

Research on Synthetic Lubricants Encouraged by Automotive Trends

By F. C. HALL*

Although the extent of natural petroleum resources appears adequate to supply the demand for lubricating oils for many years, a considerable amount of research has been and is being carried out on the subject of their synthetic production. The reasons for this are partly economic and partly with a view to the preparation of lubricants possessing superior characteristics to those obtained from petroleum. From the economic standpoint, countries dependent to a considerable extent upon foreign sources for their supply of petroleum products have investigated the possibility of their production from indigenous materials. Thus extensive research has been carried out in Germany upon the utilization of her coal deposits, through hydrogenation, low temperature carbonization and through the Fischer synthesis from water gas. In addition, the problem of the disposal of such by-product materials as cracked gases, coke oven gas, coal tar and its distillates, and low grade oils produced in petroleum refining, has further stimulated research in the direction of their possible utilization as auxiliary sources of liquid fuels and lubricants.

The present trend in automobile and aircraft engine design towards ever increasing efficiency, with higher compression ratios and increase in normal operating speeds and bearing loads, has resulted in operating conditions of a severity unknown a few years ago, and necessitates the employment of the highest grade lubricating oils available. It is becoming increasingly evident that, just as at present a considerable proportion of petroleum lubricants fail to reach the desired standard without drastic refining methods involving the use of solvent refining or hydrogenation, so in the near future there will be an increasing demand for lubricating oils of superior characteristics to those which can at present be obtained in straight petroleum lubricants.

Although in former years many viscous oils have been described as lubricants, for which the only justification lay in their viscous character, the advancement in petroleum testing technique has led to the adoption of a sounder basis for their evaluation.

Desirable Properties

The properties necessary in a high grade lubricant may be summarized as:

(a) High viscosity index.
(b) Low pourpoint.
(c) Reasonably low volatility.
(d) Minimum carbon formation in engine cylinders.
(e) Minimum tendency towards formation of sludge.
(f) High degree of oiliness.

Present research indicates that the little understood factor of oiliness, of importance under conditions where the normal lubricating film cannot be maintained, may eventually be capable of introduction into any lubricant by incorporation of a suitable blending agent, according to the type of basic lubricant, the bearing pressures encountered, and the bearing materials.

Considerable attention has been given, of recent years, to the question of the viscosity index. In the case of internal combustion engines, this property appears to be intimately connected with the problems of engine starting and efficient lubrication at low temperatures, efficient lubrication at high temperatures, oil consumption and cylinder wear. Present automobile design and operating conditions call for oils with a viscosity index in the neighborhood of 100, with the desirability of considerably exceeding this figure. Since petroleum lubricants are in general limited to viscosity indices in the neighborhood of 100, which in the case of their production from mixed base and naphthenic oil stocks necessitates extensive refining (as by solvent extraction), attention has been directed towards possible means by which this limit may be exceeded. The work of Sullivan, Voorhees, Neeley and Shankland[1] has shown that synthetic lubricating oils can be prepared, by polymerization reactions, having viscosity indices considerably exceeding this figure, although similar oils produced from technically available materials were limited to a V. I. of about 100. Recently it has been announced[2] that synthetic oils have been prepared which may be used for increasing the viscosity index of petroleum lubricants by blending with them in amounts up to 5 per cent. By this means the V.I. of a poor grade Coastal oil may be increased from about 26 up to 110, with, however, an appreciable increase in viscosity. Since other properties, such as carbon residue, stability, flashpoint, etc., are virtually unaltered, it is obviously essential to use, for blending, base oils having otherwise satisfactory characteristics. The production of such blending agents for the improvement of viscosity index may well assume a very considerable degree of importance in the near future.

Pourpoint

While it is undoubtedly desirable that lubricating oils used under low temperature conditions should possess a low pourpoint, research has shown that this factor is probably of less importance as regards engine lubrication than is the true viscosity of the oil at these temperatures. It is perhaps unfortunate that paraffin base oils, of high viscosity index, tend to possess high pourpoints but the introduction of such synthetic products as Paraflow, blending with which results in pronounced lowering of the pourpoint, enables a fairly satisfactory compromise to be obtained.

The carbon forming tendency of a lubricating oil, while still a somewhat problematical factor, appears largely dependent upon the presence in the oil of asphaltic and unsaturated constituents, and upon the overall volatility. In the case of synthetically produced oils, selection of the basic materials and of the conditions of treatment, offer means whereby these factors may be controlled. The synthetic lubricants prepared by Sullivan and others were thus found to possess very low carbon forming tendencies, a property also observed in hydrogenated oils.

The question of the stability of lubricating oils towards the high temperatures and oxidizing conditions existing in modern engines is of very considerable importance, particularly with present oil circulating systems. Unfortunately our lack of knowledge regarding the relationship of stability and lubricating oil structure, together with the lack of correlation between laboratory testing meth-

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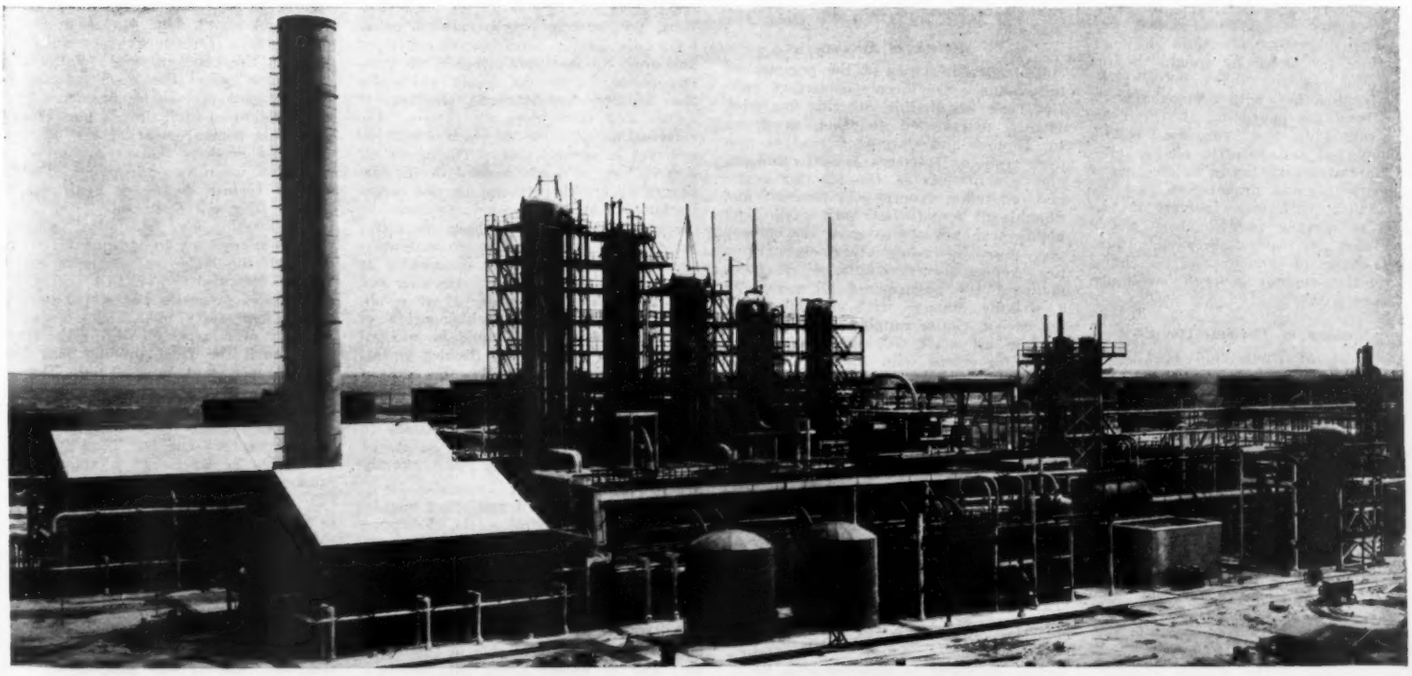
One of the Major Refinery Installations of the Past Year



New combination unit in operation at the Texas City, Texas refinery of the Pan-American Refining Corp. The unit has a rated crude oil capacity of 25,000 barrels daily in a continuous skimming and cracking operation

ods and actual service results, has seriously handicapped progress in this direction. As with the question of carbon formation, the absence of reactive constituents in the oil is essential, and may similarly be limited in the synthetic product, as exemplified in the synthetic oils previously mentioned. In this connection the use of antioxidant inhibitors may serve as a compromise until sufficient information upon the constitution of the more stable lubricants is forthcoming.

A factor worthy of mention here, which does not appear to have received the attention merited, is that of the heat absorbing capacity of a lubricant. The cooling of the piston and bearings of the internal combustion engine is effected by circulation of the lubricating oil, necessitating high pumping pressures and circulation rates for effective cooling as well as maintenance of a lubricating film in present high efficiency engines. Future research may evolve lubricating media possessing appreciably higher heat conductivity or specific heat, with resultant improvement in heat transfer from piston and bearings.

Constitution of Lubricants

Before dealing with the methods available for the synthesis of lubricating oils, brief attention may be given to the problem of their constitution. The relationship between viscosity and other properties of lubricating oils and their structure has received some attention in the past, but much more research is needed before the position is clarified. The viscosity of an oil is dependent both upon its molecular weight and its molecular constitution. The accumulation of cyclic structure, particularly aromatic rings, in the molecule has been shown to give rise to a high viscosity for a given molecular weight and boiling point, with low viscosity index and high specific gravity. Such structures are presumably present in the extracts from the solvent refining of petroleum fractions. In general the saturated naphthenic oils may be expected to possess better characteristics than those of aromatic character, and this appears in general to be supported by hydrogenation results. In the case, however, of certain pure polycyclic hydrocarbons, and coal tar fractions of polycyclic nature, the hydrogenated, more saturated derivatives show higher viscosities and lower stability than the corresponding aromatic compounds. The introduction of paraffinic structure, through substituent side chains, leads to improvement in the viscosity index with lowering of the viscosity for a given molecular weight, according to the length and relative proportion of paraffinic chains present. Such paraffinic oils show the highest values for molecular weight, boiling range and viscosity index for a given viscosity, together with a tendency towards increased pourpoint, the limit being attained in the paraffin waxes. Branching of the paraffin chains (isoparaffinic structure) leads to lowering of the pourpoint, and probably of the viscosity index, with some increase in viscosity, so that in paraffin base oils a compromise is reached between chain length, degree of branching of the chain, and relative amount of cyclic structure in the molecule.

Number of Carbon Atoms

The work of Davis and McAllister[3] has shown that some relation exists between the viscosity index of a petroleum oil and the percentage of carbon atoms in the molecule present as cyclic structure. Results obtained with the Exanol blends described previously, indicate however that viscosity index may be by no means the additive constitutional property which it has been assumed to be. Blends of petroleum oils and Exanol have been found to possess a viscosity index greater than that predicted from the V.I. of the constituents and the blending ratio, in some cases being actually greater than that of either of the constituents.

The question of the relative stability of the different structures possible in lubricating oils is a matter for future research, but it is of interest to compare the stability of such cyclic compounds as diphenyl with the comparative ease with which the higher paraffins may be oxidized at temperatures little exceeding 100°C.

Our lack of knowledge concerning the relationship between the structure of lubricants and their desirable properties indicates the very wide field existent for future research in this direction, particularly in the preparation of compounds of known structure and the determination of their salient properties in the light of modern petroleum testing technique.

Polymerization Reactions

The most obvious method for the production of molecules of a size comparable with those of lubricating oils, is by some form of polymerization reaction, and by reason of their reactive character olefinic compounds lend themselves very readily to this process. The polymerization of unsaturateds may be achieved by various means, notably by heat, pressure, silent electric discharge, and catalytic action. For the production of lubricating oils catalytic polymerization offers the widest possibilities, and of the catalytic materials available, metallic halides, notably aluminum chloride, appear most active.

The polymerizing action of aluminum chloride is complicated by dehydrogenation and disruptive processes, occurring particularly at higher temperatures, which lead to the production of complex aromatic polycyclic hydrocarbons together with low-boiling paraffinic constituents. The aluminum chloride itself combines with some of the intermediate unsaturated compounds to form a fairly stable double compound. According to Stanley[4] this double compound represents an intermediate stage in the polymerization mechanism, and is itself an active catalytic agent (having been used for this purpose in the case of lower olefins). At higher temperatures this double compound becomes more carbonaceous in character and practically inert, while the products comprise a larger proportion of light saturated paraffins with an oil of decidedly aromatic character, unsuitable for a lubricant. For this reason the majority of polymerization reactions are carried out at comparatively low temperatures, necessitating increased length of reaction time but considerably extending the useful life of the catalyst. In the case of gaseous olefins, the reaction is carried out under pressure, and generally in the presence of an inert diluent petroleum fraction to facilitate contact between catalyst and reacting material.

Effect of Olefins

The characteristics of the polymerized oil produced are largely dependent upon the type of olefinic starting material. Highly unsaturated diolefins, as shown by Thomas and Carmody,[5] tend to produce resinous polymers and are undesirable constituents in the starting material. Sullivan, Voorhees, Neeley and Shankland[1] found that both cyclic and highly branched olefins gave oils of very poor viscosity temperature characteristics. Among normal olefins, the viscosity index of the polymerized oil varied in a striking manner with the length of the carbon chain, ranging from a figure as low as —150 for ethylene, up to +138 for cetene with 16 carbon atoms. These investigators, for the commercial production of synthetic lubricants of high viscosity index, finally made use of the olefinic products from the cracking of paraffin wax and wax bearing stocks, the resultant oils having viscosity indices in the neighborhood of 100, together with excellent resistance towards sludging.

The liquid olefins normally present in cracked or other spirits may similarly be used for this purpose. Thus Fischer and Koch[6] have described the preparation of lubricants from the aluminum chloride polymerization of the unsaturateds from their synthetic "Kogasin", finding, as would be expected from Sullivan's work, that the higher fractions gave the better lubricating oils. Although the lower olefins, particularly ethylene, yield poor oils on direct polymerization, Atkinson and Storch have shown that by a preliminary thermal polymerization to a highly unsaturated light oil, followed by further polymerization of this in the presence of aluminum chloride, oils of good viscosity index may be produced from ethylene and, presumably other gaseous olefins.

Recently the production of synthetic oils of high viscosity index from the polymerization of light ends of refinery gasolines has been described.[2] These oils—Exanol oils—are stated to possess the unique property of increasing the viscosity index of blends with petroleum oils to a far greater extent than would be expected from the blending ratio on the assumption that the viscosity index of a blend is an additive property. Although details of the method of polymerization are lacking, the use of synthetic polymerized oils for the purpose of improving the viscosity temperature characteristics of petroleum lubricants has been claimed in several patents, but publication of the remarkable results obtained with Exanol will undoubtedly lend considerable impetus to synthetic lubricating oil research.

Although up to the present aluminum chloride alone appears to offer commercial possibilities as a polymerizing agent, numerous other substances have been shown to have catalytic activity in this direction. Among these may be mentioned Boron Trifluoride, whose application in the production of synthetic lubricants has been investigated in detail by Otto[7] and others, other metallic halides such as $FeCl_3$,$ZnCl_2$ etc., and activated bleaching earths. It appears probable that future research will indicate other catalytic materials possessing activity comparable with that of aluminum chloride without producing those deleterious side reactions so pronounced with that catalyst and without its rapid diminution in activity.

Non-Olefinic Hydrocarbons

Polymerization of stable non-olefinic hydrocarbons may be achieved through preliminary formation of a nascent unsaturated condition with subsequent polymerization of the resultant unsaturated residues. This condition may conveniently be reached either through a dehydrogenation or cracking process, or through chlorination followed by removal of the halogen from the molecule.

Chlorination and Dechlorination Reactions

Chlorination of paraffinic hydrocarbons, particularly in the case of petroleum distillates, proceeds smoothly at moderate temperatures, either in the gaseous phase, or in the liquid phase for the heavier hydrocarbons, leading to mono- and poly-chloro derivatives. Dechlorination of these derivatives may be achieved in several ways: The direct action of heat is found to lead to elimination of HCl with resultant partial cyclization of the unsaturated residues. In the case of the higher chloro paraffins this thermal dechlorination proceeds quite smoothly and to practical completion at temperatures below 200° C. Gardner and Bielouss[8] found that under these conditions the product of dechlorination of chlorinated middle oils could be utilized as a drying oil, having decided unsaturated characteristics. By the use of paraffin waxes as initial material, control of the degree of chlorination and the conditions of dechlorination leads to the formation of practically saturated viscous oils of presumably cyclic character[9].

The action of alkali and other metals, having a high affinity for halogens, upon chloro hydrocarbons, leads to abstraction of the halogen and a high degree of polymerization of the residues, in a manner analagous to the well-known Wurtz synthesis with sodium. Friedel and Crafts, in 1877, obtained an oily polymer from amyl chloride in this manner, and in recent years this reaction has been utilized for the production of viscous lubricating oils from chlorinated hydrocarbons. Thus Fischer, Koch, and Wiedeking[10] have described the preparation of lubricating oils from the action of activated aluminum upon chlorinated fractions from their synthetic "Kogasin." The oils prepared from the higher fractions were found to possess reasonably good viscosity temperature characteristics. In this process the reaction is complicated to a considerable extent by the polymerizing action of the aluminum chloride formed during the reaction.

Catalytic dechlorination of these chloro compounds may also be effected by the use of aluminum chloride itself. Thus the action of aluminum chloride upon a chlorinated coal tar fraction has been stated to produce an oil of lubricating characteristics[11]. In such cases the reactions taking place are undoubtedly of a very high degree of complexity.

Dehydrogenation Reactions

The polymerization of saturated, or otherwise stable hydrocarbons may be affected through an intermediate process involving either dehydrogenation or else splitting off of low molecular weight hydrocarbons, with subsequent polymerization of the resulting unsaturated residues. The simplest example of this is afforded by cracking processes in which a highly polymerized residue is produced as a by-product of the cracking reactions. Under suitable conditions this residue may be utilized as a source of lubricating or at any rate viscous oils.

The action of aluminum chloride in effecting this type of reaction is well known and has been widely used in cracking processes. Under suitable conditions, particularly at lower temperatures, the polymerizing action of aluminum chloride may be utilized with practically complete repression of any cracking tendency, notably in the case of aromatic hydrocarbons such as occur in low temperature tars. Numerous patents exist for the production of oils of lubricating characteristics through this type of reaction, particularly in those countries where the utilization of coal tars presents an industrial problem. Thus a typical patent, of the German I.G. Farbenindustrie A.G.,[12] claims the production of viscous lubricants from the action of aluminium chloride upon brown coal and other tars at temperatures between 100 and 200° C. Such oils would be of pronouncedly polycyclic character, and while considerably more stable than the viscous fractions from low temperature tars, would presumably possess steep viscosity temperature curves.

A further reaction which may be considered under this heading is that of the treatment of oils with the silent electric discharge, a procedure successfully utilized in the production of "Voltol" and "Electrion" oils. The basic reaction underlying this process is considered to be the elimination of hydrogen ions through electronic bombardment of the oil molecules, followed by polymerization of the resultant unsaturated residues, together with a certain degree of hydrogenation by the liberated hydrogen.

Voltolization may be applied to hydrocarbon as well as to natural fatty oils, although the latter submit more readily to the treatment. For this reason the commercial processes are stated to commence with fatty oils, with subsequent blending of mineral oil during the treatment until the final product may contain 90 per cent mineral oil. Due to their high molecular weight these electrically treated oils possess fairly high viscosities together with very flat viscosity temperature curves. Thus from figures given by Roegiers[13], it appears that commercial oils produced in this manner (Electrion oils) possess viscosity indices in the neighborhood of 110 to 130. The value of these oils for the lubrication of high duty gasoline engines is attested by their successful use on commercial aircraft.

The process is applicable to the treatment of low grade oils such as those obtained from low temperature carbonization, etc., and it has been shown that under this treatment these oils become

(Continued on Page 96)

World Wide Survey of Solvent Refining Units Shows Gain in Capacity

By W. T. ZIEGENHAIN

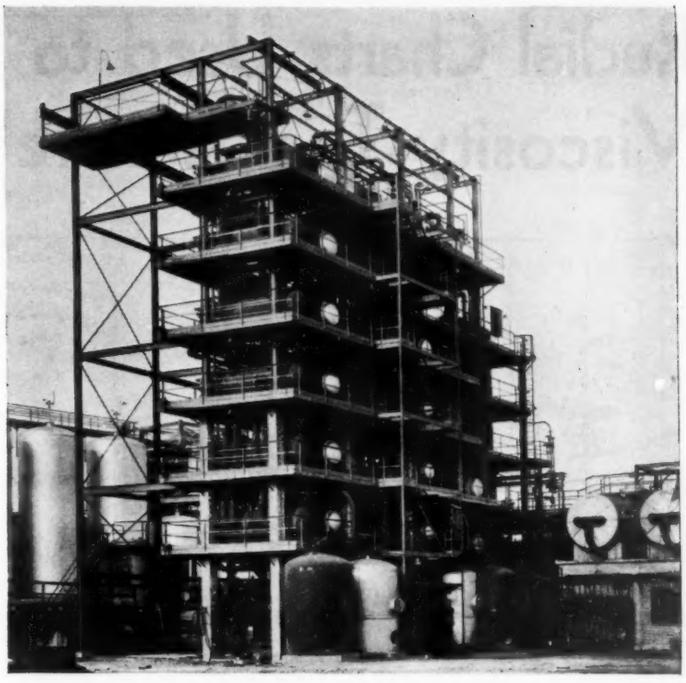
One year ago a survey of solvent refining plants under construction in the United States indicated that refiners here would spend approximately $5,000,000 for such equipment in 1934. Now that estimate appears to have been conservative. What amount refiners will spend for such equipment in 1935 will depend upon the profitable marketing of the lubricants made from these new units but a safe guess would appear to be that at least another $5,000,000 will go into similar plants this year. The progress of solvent refining and dewaxing from now on will be determined by sales of the oil rather than by technical developments because the latter is well in advance of sales. Further research may be directed on perfecting existing processes and designing smaller units which will operate economically.

Prior to 1934 solvent refined oils were looked upon as specialties but now every important motor oil manufacturer is concerned about them as "first line" products. Generally speaking, solvent oils are a little more costly to produce, especially if the refiner must junk his old equipment. Also, the relatively high cost of installing a solvent unit has tended to limit the new installations to the larger refining companies for the present. However, if solvent refined oils are to prove as popular among motorists, exporters and automotive engineers as is suggested by the acceptance of several nationally advertised solvent oils in 1934, there will be little left for all manufacturers to do but install similar equipment or lose sales volume.

Survey of Plants

The accompanying summary of solvent plants devoted to the manufacture of lubricating oils indicates a combined daily charging capacity of close to 43,000 bbls. Of this volume, approximately 34,000 bbls. is located in the United States and two-thirds of this was built in 1934. Expressing the capacity in terms of volume of finished oil the world survey indicates that the combined total daily maximum production is 28,200 bbls.

Of this amount, approximately 23,000 bbls. may be produced in the United States and the other 5,200 bbls. may be credited to foreign plants. In the year 1934, approximately 17,500 bbls. of finished oil capacity was built in the United States which represents the great bulk of the total in the world. Thus it may be seen that in 1934 the refining industry adopted the solvent treatment of lubricating oil stocks on a rather broad front and future capacity will probably have to be gained from smaller units.



General view of Atlantic Refining Co.'s new nitrobenzene solvent plant at Philadelphia, Pa. Included are the counter-current extractor, pump house and solvent recovery distillation equipment

Of the various refining companies which installed solvent units in 1934, the Standard of New Jersey and the Socony-Vacuum groups account for a large share of the total capacity. Comparatively little capacity is shown for the Mid-Continent area and relatively little is reported for the western Pennsylvania area, the principal installations being along the East Coast, Gulf Coast and California.

Of the plants most likely to be placed under construction, one is to be located at the Mid-Continent Petroleum Corp.'s plant in West Tulsa. This is expected to be a 1,500-bbl. unit. A 500-bbl. Chlorex unit is being installed in the Bradford Penn Refining Co.'s plant at Clarendon, Pa., to be ready about April 1.

Tentative plans have been made for the building of a Duo-Sol unit at the Gulf Refining Co.'s plant at Port Arthur and possibly a similar unit at the Texas Co.'s plant at Port Arthur. In all cases, however, these plans are tentative. Enlargement of the Tide Water Oil Co.'s plant at Bayonne is planned also.

Probably the largest construction work now in progress is that at the Shell Oil Co.'s plant at Wood River, Ill., where a unit of more than average capacity is being installed. At the present time the expected date of completion of the plant has not been announced, but the oils will probably be placed on the market before 1935 comes to a close.

World Survey of Solvent Refining Units for the Manufacture of Lubricating Oils

PLANTS IN UNITED STATES

Company—	Plant location	Year installed	Solvent used	Capacity of unit: Charge (bbls. daily)	Capacity of unit: Output (bbls. daily)	Nature of charge: Overhead or residuum	Nature of charge: Previously dewaxed	Vis. Index of products: Below 90 Pct.	Vis. Index of products: Above 90 Pct.
Associated Oil Co.	Avon, Calif.	1924	Liquid SO_2	1,000	700	Overhead	No	100	None
Atlantic Refining Co.	Philadelphia, Pa.	1934	Nitrobenzene	2,350	830-2,000	Optional	Optional	...	...
Bradford-Penn Refining Co.	Clarendon, Pa.	Bldg.	Dichloroethyl-ether	300-500	270-450	Optional	Partly	...	100
Gulf Refining Co.	Girard Point, Pa.	1934	Propane-cresylic acid	1,500	....	.....	.....	...	...
Indian Refining Co.	Lawrenceville, Ill.	....	Furfural	1,500	....	.....	.....	...	...
Magnolia Petroleum Co.	Beaumont, Tex.	1934	Propane-cresylic acid	2,030	1,500	Residuum	No	None	100
Mid-Continent Petroleum Corp.	Tulsa, Okla.	1932	Dichloroethyl ether	215	150	Optional	Yes	None	100
Pennzoil Co.	Oil City, Pa.	1934	Dichloroethyl ether	1,000	....	.....	.....	...	...
Shell Oil Co.	Martinez, Calif.	1929	Liquid SO_2	3,000	2,000	Overhead	No	100	None
Shell Petroleum Corp.	Wood River, Ill.	Bldg.							
Sinclair Refining Co.	Wellsville, N. Y.	1934	Nitrobenzene and sulphuric acid	1,000	850	Residuum	No	None	100
Socony-Vacuum Oil Co., Inc.	Olean, N. Y.	1934	Dichloroethyl ether	1,600	1,350	Optional	Optional	None	100
Socony-Vacuum Oil Co., Inc.	Paulsboro, N. J.	1934	Propane-cresylic acid	3,000	2,200	Residuum	No	None	100
Standard Oil Co. of California	Richmond, Calif.	1934	Aqueous phenol	3,580	2,200	Overhead	.....	...	...
Standard Oil Co. (Indiana)	Casper, Wyo.	1932	Dichloroethyl ether	500	....	.....	.....	...	...
Standard Oil Co. (Indiana)	Wood River, Ill.	....	Dichloroethyl ether	1,000	....	.....	.....	...	...
Standard Oil Co. of Louisiana	Baton Rouge, La.	1934	Phenol	5,200	....	.....	.....	...	...
Standard Oil Co. of New Jersey	Bayonne, N. J.	1934	Phenol	1,000	....	.....	.....	...	...
Texas Co.	Port Arthur, Tex.	....	Liquid SO_2	1,000	....	Overhead	.....	...	...
Tide Water Oil Co.	Bayonne, N. J.	1931	Liquid SO_2	2,000	Variable	Optional	Yes	None	100
Union Oil Co.	Oleum, Calif.	1934	Liquid SO_2	1200-1,500	420-540	Optional	Optional	...	...

PLANTS IN FOREIGN COUNTRIES

Argentine Government Oil Fields	La Plata, Arg.	....	Liquid SO_2	1,050	....	Overhead	.....	...	...
Burmah Oil Co.	Rangoon, India	....	Liquid SO_2	1,750	....	Overhead	.....	...	...
Herbert Green & Co., Ltd.	Lincolnshire, England	....	Propane-cresylic acid	1,000	....	.....	.....	...	...
Imperial Oil, Ltd.	Sarnia, Ont., Canada	1930	Phenol	2,000	....	.....	.....	...	...
Min. Oelwerke Rhenania	Monheim, Germany	....	Liquid SO_2	42	....	Overhead	.....	...	...
Rhenania Ossag, A.G.	Hamburg, Germany	....	Liquid SO_2	1,750	....	Overhead	.....	...	...
Standard Franco-Americaine	Port Jerome, France	1933	Phenol	1,500	....	.....	.....	...	...

Radial Charts Used to Supplement A. S. T. M. Viscosity-Temperature Curves

By RICHARD GROSHOLZ

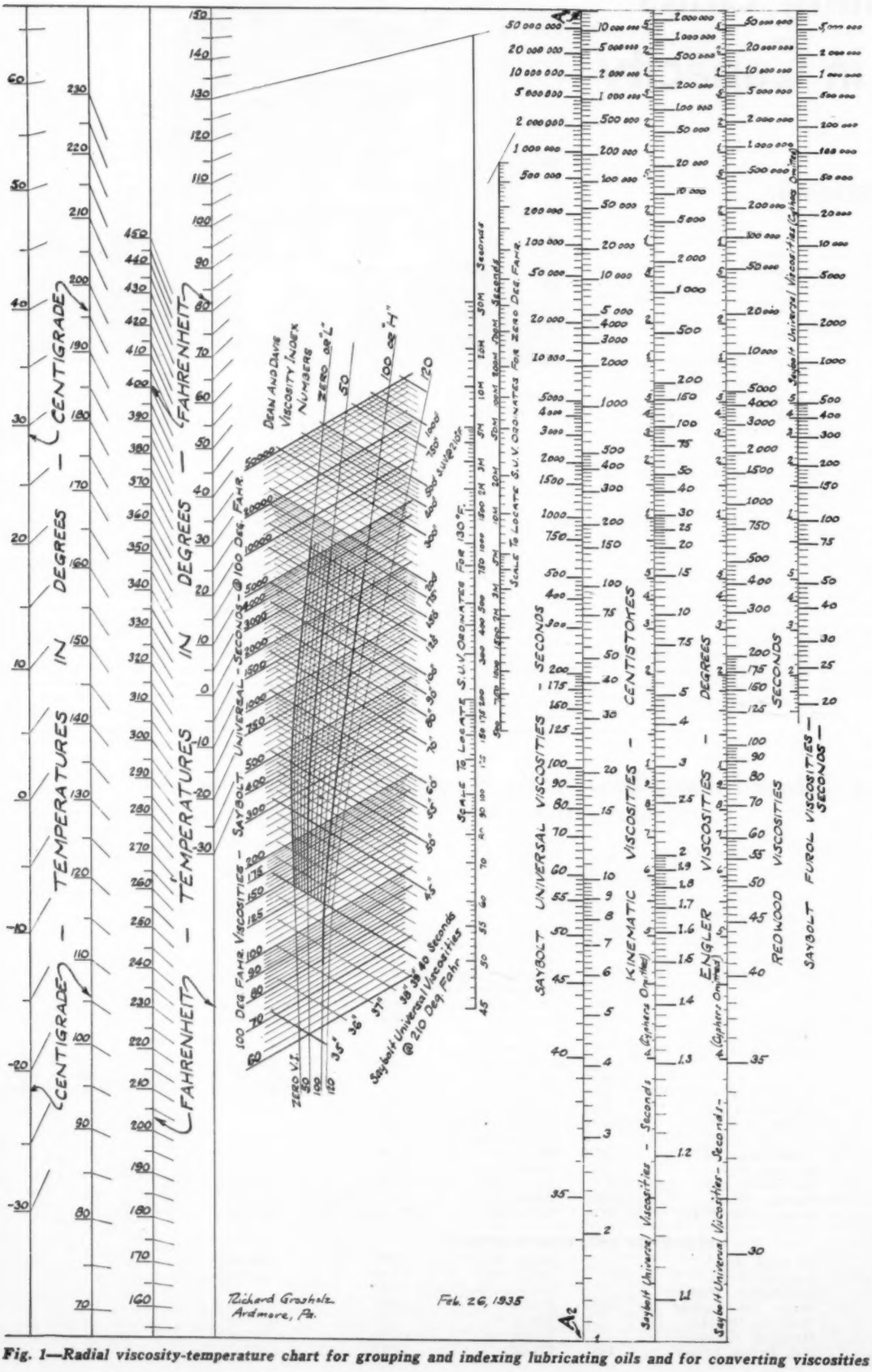

CENTIGRADE — TEMPERATURES IN DEGREES — FAHRENHEIT
FAHRENHEIT — TEMPERATURES IN DEGREES — CENTIGRADE
DEAN AND DAVIS VISCOSITY INDEX NUMBERS
ZERO 100
100 DEG FAHR VISCOSITIES - SAYBOLT UNIVERSAL - SECONDS @ 100 DEG. FAHR.
SCALE TO LOCATE S.U.V. ORDINATES FOR 130° F.
SCALE TO LOCATE S.U.V. ORDINATES FOR ZERO DEG. FAHR.
Saybolt Universal Viscosities @ 210 Deg Fahr
SAYBOLT UNIVERSAL VISCOSITIES - SECONDS
KINEMATIC VISCOSITIES - CENTISTOKES
ENGLER VISCOSITIES - DEGREES
REDWOOD VISCOSITIES SECONDS
SAYBOLT FUROL VISCOSITIES — SECONDS —
Saybolt Universal Viscosities - Seconds (Cylinder Oil Only)
Richard Grosholz Ardmore, Pa.
Feb. 26, 1935

Fig. 1—Radial viscosity-temperature chart for grouping and indexing lubricating oils and for converting viscosities

The Viscosity Temperature Chart, No. D-341-32T, published by the American Society for Testing Materials, was developed to permit the plotting of the variation in the viscosity of any oil with temperature, as a straight line. A series of radial charts has been developed providing an alternate method of presenting similar data. It should be stated that these are supplementary to the A.S.T.M. chart, rather than competitive. The Saybolt Universal scale, and the kinematic viscosity scale, above 38 seconds Saybolt, are copied from the A.S.T.M. chart, and the lines indicating temperatures are applied in accordance with the law followed in the chart quoted. The transformation effected permits certain types of inspections and specifications of oils to be performed with greater ease than the source chart permits, while other operations may be more properly performed on the original.

As already mentioned, an oil is characterized on the A.S.T.M. chart by the straight line which is the record of its viscosity temperature relation. On these present charts, any oil is represented by a point, at which point lines indicating any viscosity of the oil at any temperature intersect. Being represented by points, the oils are readily divided into groups by straight lines or by curves which may represent gravities, or indices, or special viscosities. The function of the source chart is to permit viscosities of oils to be found at any temperature, when the viscosities are originally only known for two temperatures. In its turn this operation is not performed so conveniently on the radial chart.

Early Work

Before the method of comparing oils by change of viscosity with temperature was systematized by Dean and Davis in 1929,[3] two viscosities were not frequently included in the description of a lubricant. Since then, too, the scope of viscosity-temperature change has been emphasized by the publication of the A.S.T.M. chart. Research with motor oils and consequent new motor oil specifications have focused the attention of those concerned with lubricants on the importance of viscosity characteristics.[16, 17] Improvement of viscosity index has become a major objective in refining, and specifictaions are being written, more and more, on a basis of reasonable viscosity-temperature relationship.

The Oil and Gas Journal has carried much information on viscosity index, as Dean and Davis, together with Lapeyrouse, published an amplification and revision of their work in this paper,[3] and Larson and Schwaderer have likewise shown further developments and graphical applications of viscosity index in this magazine.[4] It is then readily recalled that the viscosity index, indicating as it does the resistance of an oil to change of viscosity with change of temperature, and bearing a relation, more particularly in times past, to the sources of oils, is plotted or computed from data consisting of Saybolt Universal viscosities at 100° and at 210° F. A further use of this combination of viscosities was developed two years ago when tentative winter oil specifications were established by the Society of Automotive Engineers.[17] These specifications limited oil grades by viscosities which the oil should possess at 0° F. At the present time the obtaining of viscosities at 0° F. is not a customary nor an at all established laboratory pro-

cedure, and it is required that the 0° F. viscosity be found by extrapolating the customary viscosity temperature relationships as plotted on the A.S.T.M. chart. It appeared that it might be convenient to have a diagram which would permit a zero viscosity to be approximated without the necessity of extrapolating on the A.S.T.M. chart, and it has been the privilege of the present author to have had a diagram published which showed at once both viscosity indices and classifications at low temperatures.[1]

In attempting to draw a similar chart for heavier oils, as for rear axle lubricants, it became apparent that there were no widely recognized specifications for the heavier oils at low temperatures. It is therefore desired to offer a diagram which will lend itself to the devising and comparison of viscosity specifications of all kinds.

Derivation of Radial Charts

In a most carefully prepared work, Docksey, Hands and Hayward published a set of four drawings, last year, for finding Dean and Davis viscosity indices for oils whose viscosity temperature relationships are expressed in units which are in accord with technical practice in

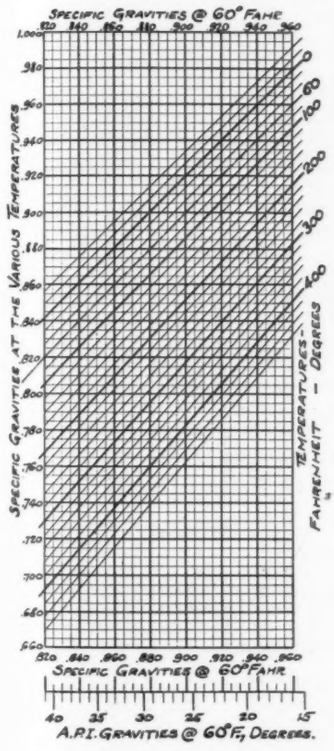

Specific Gravities @ 60° Fahr
Specific Gravities at the Various Temperatures
Temperatures - Degrees Fahrenheit
A.P.I. Gravities @ 60° F, Degrees.

Fig. 3—Gravity variation with temperature

British and Continental laboratories.[1] A technical detail brought out by their work was that if horizontal and vertical ordinates representing viscosities at the appointed higher and lower temperatures were laid out to scales proportioned according to the same law, the curves representing the various grades of viscosity index would straighten out and become linear for a large part of the range of the oils.

It occurs that when identically constituted scales are used, as suggested by the work just referred to, not only are the lines of equal viscosity index largely straight, but lines of a special viscosity relation plotted on the chart are absolutely straight. Figure 5 is provided to illustrate the method of composition of these radial charts. On a chart on which viscosities at 100° and 210° F. are laid out on equal scales at right angles, the ordinates are extended so that several vertical and several horizontal ordinates of equal value intersect. Through these intersections a straight line may be drawn which will fall at 45 degrees with the horizontal. Let us consider the intersection of the ordinates representing 90 seconds S.U. viscosities. On this layout, a line representing a viscosity of 90 seconds S.U. viscosity at any temperature may be shown to pass through this intersection. The angle which the line representing 90 seconds S.U. viscosity at an intermediate temperature makes with the regular axes is proportioned to the angle between the axes, 90 degrees in Figure 5, in accordance with the manner in which the temperature lines are laid out in the A.S.T.M. chart. Thus the temperature represented by the line bisecting the angle between the 100° and 210° F. axes is 152.4° F., because the logarithm of the absolute temperature equivalent of 152.4, i.e., of 612, lies midway between the logarithms of the absolute temperature equivalents of 100° and 210° F.; that is, between the logs of 559.6 and 669.6. This detail gains importance in the charts, Figures 1 and 2. It will be noticed that temperatures below 152.4° F. in these charts are referred to the upper focal point, A1, and higher temperatures to the lower focal point at A2.

Again referring to Figure 5, to find the directional angles for all temperatures above 152.4° F.:

$$\text{tang. n} = \text{tang.}\left(\frac{B}{2}\right)\frac{\text{Log N} - \text{Log 612}}{\text{Log 669.6} - \text{Log 612}}$$

where "N" is the number of absolute degrees of temperature, F., of a temperature whose directional angle is required, and where "B" is the angle between the 100° and 210° F. ordinates, and where "n" is the directional angle required.

For temperatures below 152.4° F., the same formula applies with the sign of the result reversed.

The direction of any of these lines may be checked on a proper viscosity index chart by means of the A.S.T.M. chart; or in the absence of an A.S.T.M. chart, any directional line for any temperature may be plotted on a properly constituted viscosity index chart by means of this formula.

Description of Chart, Figure 1

Figure 1 finally consists of six items: First, an intersection line, A1A2, on which ordinates representing all temperatures of any scale all may meet at any possible viscosity; the intersection line being graduated in Saybolt Universal and in kinematic viscosities. Secondly, a system of ordinates representing viscosities at 100° F., intersecting with a system of ordinates representing viscosities at 210° F., and both systems originating in the intersection line A1A2. Third and fourth, systems of guide marks for all Fahrenheit and for all Centigrade temperatures; any mark of which series, when connected up with either A1, or to A2, as the mark may indicate, will form a line, to which line all ordinates representing viscosities at that selected temperature must be parallel. Fifth are the parallel scales of Engler, Redwood and Saybolt Furol viscosities, which must be applied to line A1A2 before being used with the temperature lines. Sixth, the lines of equal viscosity index with Dean and Davis numbers have been plotted on the 100°-210° F. co-ordinate system.

Two special Saybolt Universal scales have been added to assist locating ordinates for viscosities at 0° and at 130° F.

The whole diagram has been assembled so that the 100°-210° F. co-ordinates are at 60 degrees to each other instead of at right angles. If they had been laid out at right angles, the diagram would have been so compressed in its narrow dimension, that for the same length of drawing, the distance between zero and the 120 viscosity index line would have been only one-half of the distance which separates them in the present arrangement. In laying out and lettering the diagram, the intention has been to make the 100° F. viscosity lines appear approximately horizontal, and the 210° F. lines appear approximately vertical.

Examples of Problems

A chief function of the work is to divide oils into groups according to any viscosity specification at any temperature. For instance, 10W oils are those

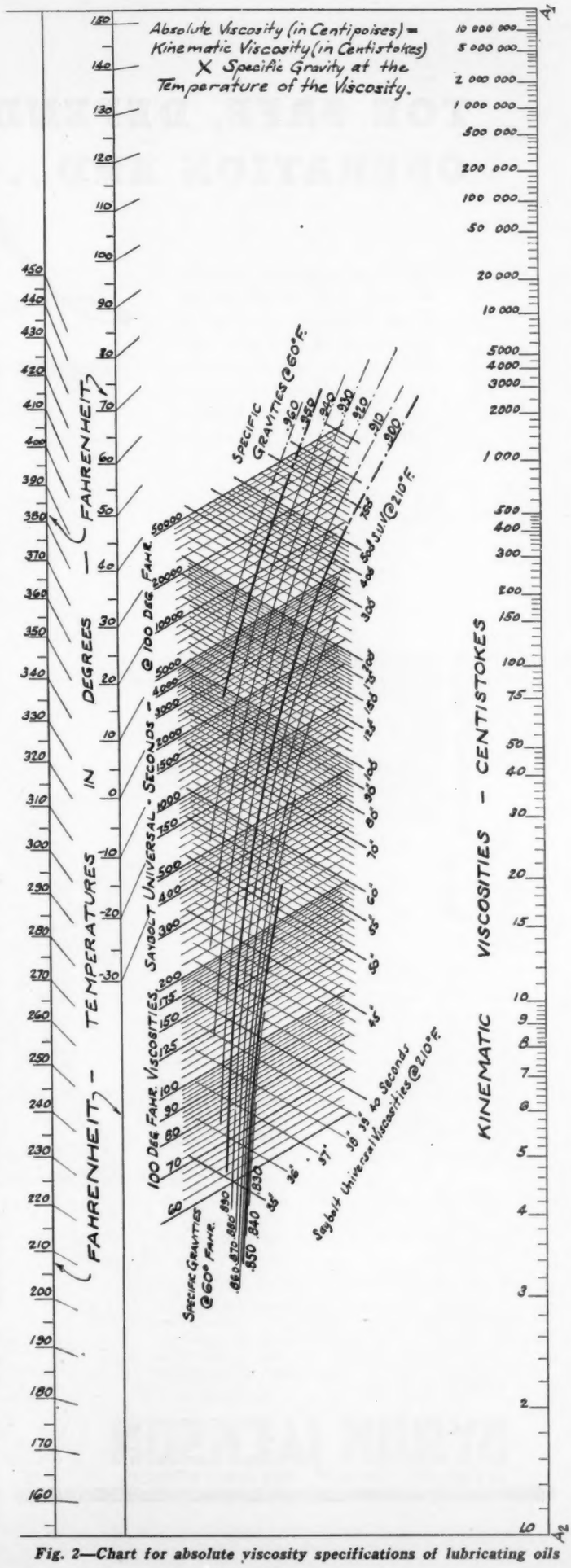

Absolute Viscosity (in Centipoises) = Kinematic Viscosity (in Centistokes) X Specific Gravity at the Temperature of the Viscosity.
Fahrenheit - Temperatures in Degrees - Fahrenheit
100 Deg Fahr Viscosities, Saybolt Universal - Seconds @ 100 Deg Fahr.
Specific Gravities @ 60° Fahr
Saybolt Universal Viscosities @ 210° F.
Kinematic Viscosities - Centistokes
A1
A2

Fig. 2—Chart for absolute viscosity specifications of lubricating oils

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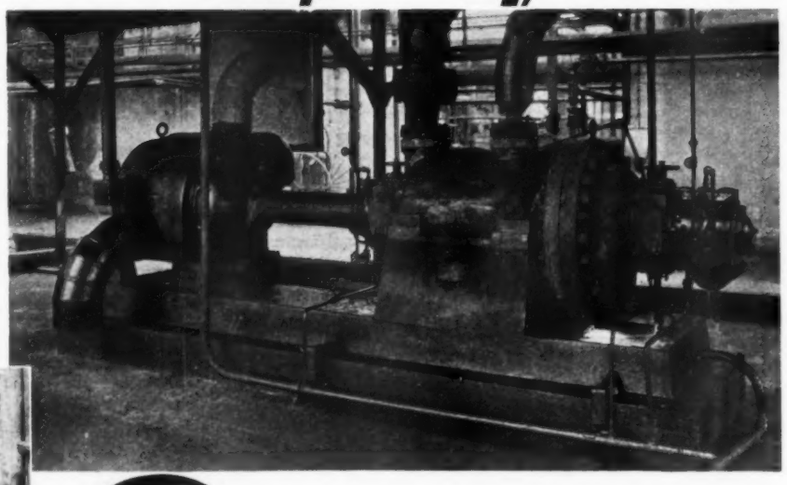

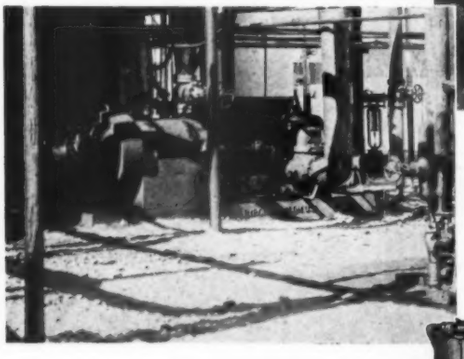

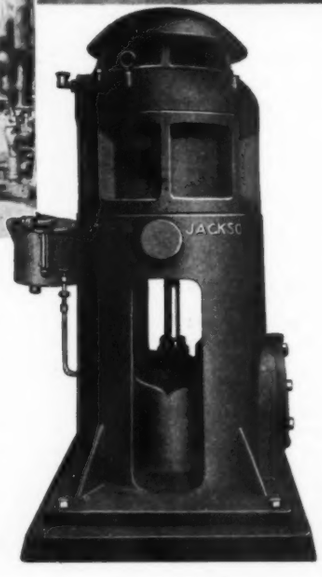

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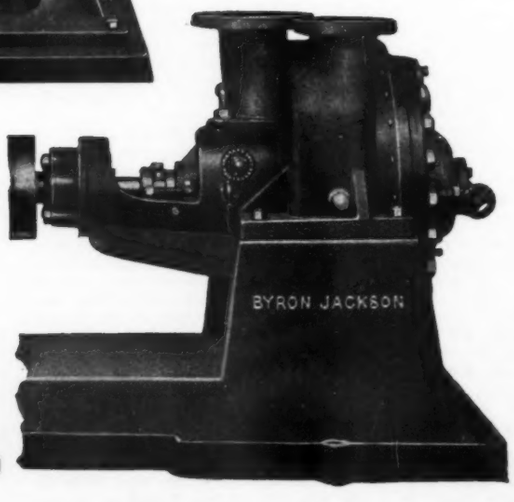

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whose viscosities at 0° F. are between 5,000 and 10,000 seconds S.U., and as mentioned before, we depend on 100° and 210° viscosities to tell whether this condition is met or not. If lines are drawn to represent 5,000 seconds S.U. viscosity at 0° F., and also 10,000, intersections of actual viscosity determinations at 100° and at 210° F. of 10W oils must fall within the band which these 5,000 and 10,000-second lines will indicate. With the special zero scale shown, on Figure 1, one may draw a line through the 5,000-second Saybolt Universal mark on A1A2, and through the 5,000-second mark on the special 0° F. line, and continue this line across the 100°-210° F. co-ordinate system. This line will then indicate the lower limit of the 10W group.

Figure 6 gives a general example of the same practice. We will indicate the oils whose viscosities are exactly 5,000 seconds S.U. viscosity at 50° F. Using a straight edge of a piece of paper to transfer a distance, mark off from A2 to 5,000 Saybolt Universal, and lay this distance off from the 50° mark on the Fahrenheit scale, in a downward direction. Connect the point so established with a line to the original 5,000-second S.U. viscosity mark on A1A2. Then all oils whose 100° and 210° S.U. viscosities intersect at this line will exhibit a viscosity of 5,000 seconds S.U. at 50° F., and those whose viscosities intersect above this line will have higher viscosities at 50° F., and vice versa.

In moving our length 5,000 S.U. viscosity to A1, and laying it off we have drawn a line which is exactly parallel to the 50° F. to A1 directional line, to which all viscosity ordinates for 50° F. must be parallel on this chart.

There are many new classifications of this type still to be established. In gear lubrication, for instance, a viscosity of 130,000 centistokes at 0° F. has been mentioned as a limit for some types of transmissions.[3] In another instance, a viscosity of 100,000 seconds S.U. viscosity is discussed for a free-wheeling application.[4] In each of these cases various temperature limits might be suggested. The problem was suggested, in connection with this second instance, of drawing a chart which would show at what temperature any particular oil would reach the viscosity of 100,000 seconds S.U. viscosity. Figure 8 shows how easily such a study is made on this radial chart, a series of lines of 100,000 seconds S.U. viscosity at various temperatures being laid down exactly as shown in the foregoing example, in Figure 6. Industrial lubrication abounds with opportunities of determining what oils might fit a given specification.

When viscosity requirements are suggested at two temperatures, one, say, for providing safe lubrication for running conditions, and the other as a limiting low temperature in starting, it is an easy matter to plot these temperatures on the A.S.T.M. chart, and then to pick off the properly identifying viscosities at 100° and 210° F. Further reference would have to be made to determine the viscosity index and establish the type of oil which would be called for. On this radial chart, if two specifications at different temperatures are plotted as given in the example, one oil will be indicated by the intersecting specifications. The oil will at once be identified by its 100° and 210° F. viscosities, and its viscosity index may be read off at the same time. This matter is exemplified incidentally in the next problem.

In the American practice of testing lubricating oils with the Saybolt Universal instrument readings, as continually mentioned here, are usually taken at 100° and 210° F. In England the Redwood viscosimeter is used and 100° and 200° F. readings are customary. Continental practice with the Engler viscosimeter frequently use temperatures of 50° and 100° Centigrade. This diagram lends itself to the identification of oils in Saybolt units under customary conditions where the oils are described according to other standards at other temperatures.

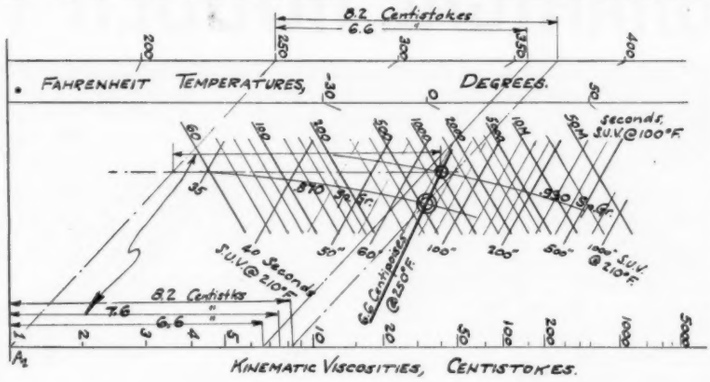

Fig. 4—Chart for laying out absolute viscosity relations

Viscosity conversions at identical temperatures may be made on Figure 1 by a simple transfer sidewise from one scale to another. The Saybolt Universal scale is repeated alongside of each other scale in order to facilitate this transfer. It is proposed in Figure 7 to find the Saybolt Universal identification at usual temperatures of an oil which is noted as having Engler viscosities of 30 and of 3 degrees at 50° and at 100° C. It is to be noted that both Engler viscosities are first transferred sidewise to the A1A2 line. Further procedure is the same as in finding a given specification at a given temperature. The distance 30-degree Engler to A1 is transferred to the Centigrade line with the 50° mark, and the distance is measured down the scale, and a line drawn from the point established on the Centigrade line back to the point to which 30-degree Engler was established on the A1A2 line. Likewise 3-degree Engler is transferred sidewise, measured off, transferred to the Centigrade line containing the 100° mark, and laid off up the scale, and the second specification line is drawn back over the diagram to the point where 3-degree Engler was laid off on A1A2. The 100°-210° F. Saybolt viscosities are then read off at the intersection, and are found to be 2,600 and 104 seconds, respectively. If the problem were worked on Figure 1, the viscosity index would be noted to be 18.

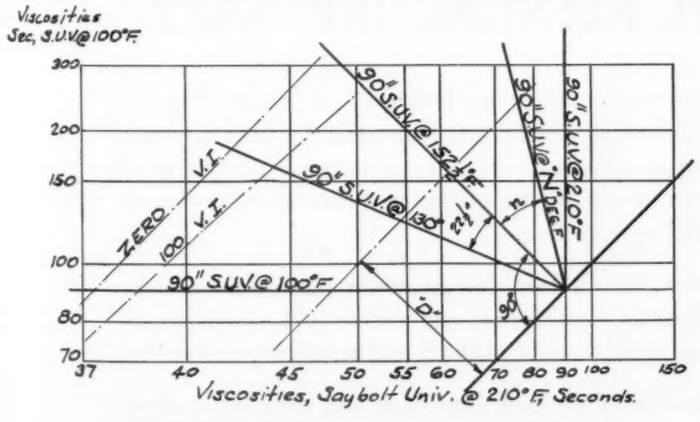

Fig. 5—Method of composition of radial charts

In this last example it is necessary to emphasize two rules concerning the use of this chart. First, all specification lines must pass through a properly evaluated point on line A1A2, as this is the line from which all lines characteristic of the various temperatures radiate. Secondly, no transferring is done back and forth between the temperature lines, as these temperature marks, in the position in which they are shown, properly indicate, with Points A1 or A2, the characteristic angle required.

It is the province of the A.S.T.M. chart to show a viscosity at a third temperature, where two viscosity-temperature relationships are already known, and have been properly plotted. Going back to Figure 6, an example of the solution of such a problem is shown on the radial chart. Let us find the viscosity at 200° F. of an oil whose viscosities at 100° and at 210° F. are respectively 100 seconds and 40 seconds. A line is required through the intersection stated parallel to line A1A2. Where a T-square and other drafting tools are not at hand, one may take a piece of paper and measure the distance from the given intersection to the long lines on either side, getting distances B and C in Figure 6; mark these distances off on the end of the diagram, and so draw the needed parallel; then draw the directional line from the 200° F. mark to A2. Measure from the intersection of the inclined line and the parallel along the parallel to the 100-40-second ordinate intersection; lay this measurement off from A2 on the Saybolt Universal scale and note 41.5 seconds S.U. viscosity to be the viscosity at 200° F., which is required.

Dividers and triangles are distinctly useful instruments for use with this diagram, but as many an indicator card has had its area taken without the use of a planimeter, so can this diagram be handled with the edge of an envelope.

Viscosity Indices

Several systems of comparing lubricating oils on the basis of resistance to change in viscosity with change in temperature have been suggested. While the Dean and Davis system is widely used and referred to, so much so that whenever the term "viscosity index" is used, the Dean and Davis figures are meant, it is a fact that this specification is not as yet officially accepted as a standard. Docksey, Hands and Hayward[1] mention their consideration of viscosity indexing systems before electing to use the Dean and Davis figures in their graphical presentation. In the radial chart in Figure 1, divisions based on the Dean and Davis formula are incorporated, but any other system could have been incorporated into this chart.

Reviewing the Dean and Davis system further than was done earlier in this article, it is recalled that, for each second of S.U. viscosity between 40 and 160 at 210° F., two corresponding viscosities at 100° F. were quoted; one, the higher viscosity shown by the average napthene base oil, and the other the lower viscosity characteristic of the average paraffin base oil with its comparatively greater resistance to viscostiy temperature change. Of the two series of viscosities formed, the paraffin average is called the "H" series, and the list of viscosities of average napthene oils is called the "L" series. An oil's index depends on the arithmetical relation which its 100° F. S.U. viscosity occupies between the H and L viscosities, which correspond to the oil's own viscosity at 210°F., and so the Dean and Davis system specifically compares the change in viscosity over the 100°-210° F. interval. On account of some of the S.A.E. grades being named at 130° F., oils are frequently characterized by viscosities at 100° and at 130° F. The suggestion arises to derive corresponding H and L series at 130° F., so that the viscosity index can be found from these two viscosities. Larson and Schwaderer point out that Dean and Davis indices found from data taken at 130° and 210° F. do not agree with indices for the same oil found from data taken at 100° and 210° F.[5] The reason that the two indices do not agree is because the Dean and Davis system divides the space on the viscosity scales into arithmetically equal intervals, and, as the scale varies in accordance with a different rule, i.e., in accordance with the logarithm of the logarithm of the viscosity, a fraction of a 100°-210° F. interval on the A.S.T.M. chart is not in proportion to an equal fraction of the 130°-210° F. interval for the same oil. In the system of indexing which Larson and Schwaderer present by a graphical method, they divide the spaces between the napthene and the paraffin oils equally on the viscosity scale, with the result that indices derived from viscosities taken at either set of temperatures agree exactly. In this radial chart, as all combinations of viscosity-temperature relationships always refer back to the single point which is located by the viscosities which the given oil has at 100° and at 210° F., only one Dean and Davis index value can be obtained, regardless of the temperatures of

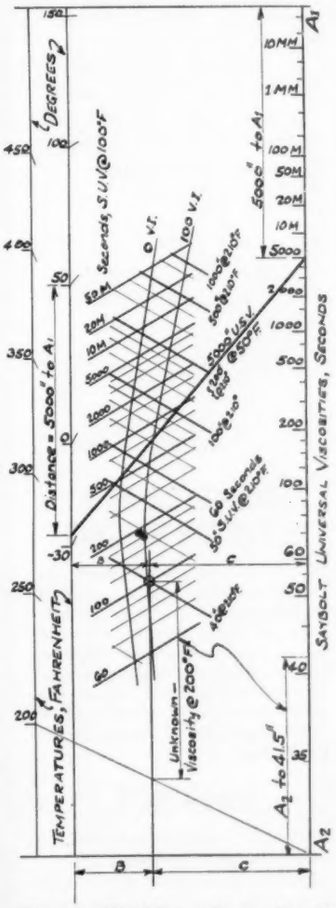

Fig. 6—Working chart showing conversion of 5,000 seconds S. U. viscosity oil

[1] Docksey, Hands and Hayward, Proc. Inst. Mech. Engrs., 1931, 1, 1.
[2] Dean and Davis, Chem. & Met. Eng., August, 1929, 418.
[3] Larson and Schwaderer, Trans. A.S.M.E., 1933, 55, 1.
[4] Larson and Schwaderer, Trans. A.S.M.E., 1933, 55, 1.
[5] Larson and Schwaderer, Trans. A.S.M.E., 1933, 55, 1.

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observation, provided that all the known viscosity-temperature relationships of the given oil fall in a straight line on the A.S.T.M. chart.

In laying out the H and L curves on Figure 1, the revised data of Davis, Lapeyrouse and Dean[3] are employed, with the exception that the more recent data proposed by Fenske and McCluer,[11] and expressed by them in centistokes, form the portion of the H curve below 55 seconds at 210° F. The parts of the index curves shown in light lines are extrapolations beyond the data given in the references.

Viscosity Scales

While equivalents for the Saybolt Universal scale are shown here in other systems, it is realized that on this item, this diagram is subject to eventual revision. The A.S.T.M. subcommittee on viscosity

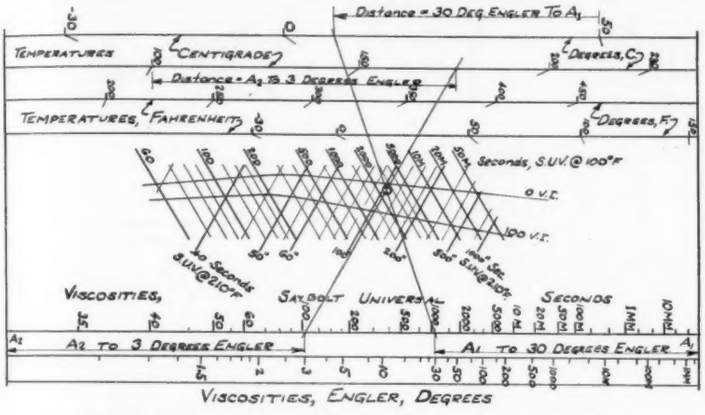

Fig. 7—Viscosity conversions from one scale to another

have a wide program at hand in regards to revision of viscosity standards. This program includes standardization of the Saybolt instrument, determination of the correct relation of Saybolt Universal viscosities to kinematic viscosities throughout the range of the scale, and correction of the law by which the scales are plotted on the A.S.T.M. chart. Thus, as the A.S.T.M. chart will eventually be revised, all material dependent upon it will stand in need of revision.

The five viscosity scales of Figure 1 have appeared recently in a very similar form in the National Petroleum News.[12] They had been sketched out on this drawing before their appearance in publication, but the author wishes to acknowledge a debt on one item in this matter. The idea of repeating the Saybolt scales to facilitate the transfer of readings from one scale to another has been adapted from the chart which appeared in the National Petroleum News.

Gravity Viscosity Specifications

Viscosity gravity constants were developed by Hill and Coates[9] as a method of recognizing the base of oils from gravities at 60° F. and from viscosities at either 100° or 210° F. This method of inspection antedates viscosity index. In 1932 McCluer and Fenske derived a relationship between viscosity gravity constants and viscosity index.[10] This was expressed in a group of curves showing gravity as a function of viscosity for oils of types varying from 120 viscosity index to zero viscosity index. With this data and with the viscosity index chart of Figure 1, it has been possible to draw a set of curves which would show what gravities would be exhibited by oils of various viscosity characteristics at 100° and at 210° F., as is shown in Figure 2. This chart has been drawn to assist in the solution of problems involving absolute viscosities, but it can be employed in connection with any of the foregoing problems where a viscosity gravity specification is given in place of a specification consisting of two temperature-viscosity relations. One remembers that in the large Larson and Schwaderer charts[4] these curves of gravity and of viscosity index were superimposed, but distinct on the same drawing. On account of the construction involved, these curves cannot all be placed on one of these radial charts, but problems of recognizing special viscosity temperature specifications or of converting to different systems may be solved by working from one chart to the other. The systems of 100°-210° F. viscosity ordinates and their relation to the kinematic viscosity scales on A1A2 are identical in both drawings, and a viscosity ordinate intersection found on one drawing may be transferred to the other.

The relation between viscosity gravity constant and viscosity index is an average one, and in instances where an inspection of an oil contains both usual viscosities and the gravity, the curve indicating the proper gravity may not pass exactly through the proper intersection on Figure 2. McCluer and Fenske discuss the variation between gravity constant and index, and they show where the viscosity gravity constant may be more dependable in the case of the lighter oils than the viscosity index. All gravities can be accurately determined, but the Saybolt instrument is not considered accurate for viscosities in the neighborhood of 40 seconds or lower. Thus judging an oil by its gravity and its 100° viscosity may give the more accurate inspection in the lighter grades. In heavier grades of oil, disagreement between index and gravity constant may reflect the way in which the oil has been refined, though the reference given does not make this last statement.

Absolute Viscosities

Figure 2 has been drawn to assist in preparing an absolute viscosity specification. Repeating the relation printed on the top of the chart:

> Absolute viscosity = kinematic viscosity × specific gravity at the temperature of the viscosity.

Absolute viscosities are the final means for comparing oils for a particular application on a basis of viscosity. The unit weight of an oil has no effect on its true viscosity, but it affects readings in the usual viscosimeters because of the greater "head" causing quicker flow in the case of a heavier oil. Absolute viscosities are only occasionally mentioned in automotive work, for one reason because the wide and rapid variation of operating conditions for any automobile engine make such a refinement in the specification of a lubricant superfluous.

There is one example at hand from the literature of the use of absolute units for automotive work, in which case 700 stokes and 1,400 stokes at 0° F. are shown to be practical high limits of viscosity in shifting gears on certain transmissions.[5] These limits could be laid out readily on Figure 2 to indicate oils described in customary units which would meet these conditions. All analytical formulae relating to friction employ absolute viscosities.[13] In his book on "Power Plant Lubrication," W. F. Osbourne advises the use of absolute viscosities for certain purposes.[14] It is evident that the chief benefit to be derived from any use of an absolute viscosity specification is in connection with the lubrication of industrial machinery, in instances where there are large numbers of similar machines operating under constant conditions.

An example of laying out an absolute viscosity specification is given in Figure 4. Assuming S.U. viscosities at 100° and 210° F. of 1,000 and 72 seconds, and a specific gravity of .930, let us find the absolute viscosity of this oil, and then let us indicate what other oils have the same absolute viscosity at 250° F. We shall find the kinematic viscosity and the gravity of the oil at 250° F., multiply them together and divide by the gravity of another oil at that temperature, to find the kinematic viscosity of the other oil; and where the new kinematic viscosity and the newly selected gravity intersect on Figure 4 there will be a second point on the desired line of absolute viscosities.

From the gravity temperature variation chart, Figure 3, we find a gravity of .930 at 60° F. to correspond to a gravity of .865 at 250° F. By the method described on the lower end of Figure 6, we find the kinematic viscosity at 250° F. of our 1,000-72 S.U. viscosity at 100°-210° F. oil to be 7.6 centistokes. The absolute viscosity of this oil at 250° F. is then 7.6 × .865, or 6.6 centipoises.

Next, selecting .870 as a corresponding gravity at 60° F., for lighter gravity oils, we find this gravity to drop to .823 at 250° F. An absolute viscosity of 6.6 centipoises divided by gravity of .823 calls for a kinematic viscosity of 8.2 centistokes at 250° F.

We lay out this specification of 8.2

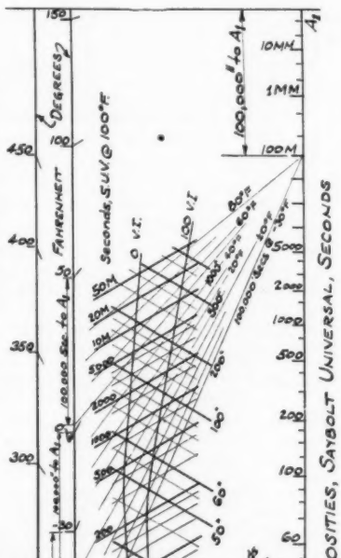

Fig. 8—Chart showing solution of temperature at which any oil will have a viscosity of 100,000 seconds S. U.

centistokes at 250° F. again as given in Figure 6. This new specification intersects the .870 gravity line, thus plotting a second oil whose absolute viscosity is 6.6 centipoises. Connecting this point with the intersection representing the original oil gives a specification line naming all oils in terms of usual Saybolt units, whose absolute viscosity at 250° F. is 6.6 centipoises.

Where the problem is to lay out a specification and not to match a given oil, a specification line representing a kinematic viscosity numerically equal to the absolute viscosity called for, and at the same temperature, should be drawn at first. This will point out the gravities of the oils to be considered. More than two points should be drawn in, in the case of lower viscosities, as the absolute viscosity specification in the lower ranges is only approximated by a straight line.

My thanks are due to Dr. J. C. Geneisse of the Atlantic Refining Co. and the chairman of the A.S.T.M. subcommittee for the time which he has given to me in discussion of these charts, and for information on the work of the subcommittee which affects such devices. I also wish to thank Dr. E. W. Dean of the Standard Oil Development Co., A. G. Marshall of the Shell Oil Co., A. L. Clayden of the Sun Oil Co., and J. G. Detwiler of the Texas Co. for their kindness in writing me letters of comment at my request on a chart of this type which was submitted to them.

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PERFUME FROM GASOLINE

After experimenting for three years, two chemistry professors at Mississippi State College have discovered that certain aldehydes, the artificial aroma-producing chemicals, can be taken out of common gasoline at the low cost of $26 a gallon. Perfume manufacturers in this country and abroad have shown great interest in the discovery, since by the old method of producing aldehydes the cost is about $250 a gallon.

Reid Vapor Pressure Test Procedure Must Be Carefully Followed

By The N. G. A. A. TECHNICAL COMMITTEE

The Reid vapor pressure method, six and one-half years after its adoption by the Natural Gasoline Association, can be safely said not only to have met the requirement for a satisfactory method for determining the vapor pressure of natural gasoline, but also to be finding greater utility in the field of refinery products. The adoption of the Reid method climaxed approximately two years of intensive study by the association of various vapor pressure methods. The selection of the Reid method was based primarily both on the soundness of principle involved and its ruggedness of construction which made it adaptable equally well to both laboratory and field usage.

Since the adoption of the Reid vapor pressure method, the importance of vapor pressure as a quantitative characteristic of natural gasoline and motor fuel has been steadily increasing. Reid vapor pressure is the most important specification in the new grading system for natural gasoline which was adopted as a tentative standard by the association January 1, 1931, and which became a permanent standard one year later. Reid vapor pressure used in conjunction with A.S.T.M. Engler distillation points gives a quantitative index to the composition of natural gasoline. The recent work of Bridgeman on vapor lock was based primarily on vapor pressure as determined by the Reid method. Government motor fuel specifications include Reid vapor pressure. Most contracts now being made for motor fuel include Reid vapor pressure specifications.

More exacting requirements have arisen with the greater use of Reid vapor pressure and have been met or anticipated with further refinement in procedure in making the tests.

Major Advantages

The Reid vapor pressure method has the major advantages of simplicity and ease in manipulation. No special training or knowledge is required to obtain satisfactory and duplicable results. Unfortunately these very virtues tend toward laxness and carelessness in the tests. A simple test seems to imply to many that no special care is required to obtain accurate results. This idea is entirely erroneous since in the simplest test the accuracy of the result depends in just as great a degree on the precision employed in making the several measurements as in a more complicated test.

The possible effect of carelessness or inaccuracy in measurements is best demonstrated by a detailed study of every factor affecting the final result of the test. The sources of error are distributed among four major groups which in turn consist of several separate items. These possible sources of error are shown in the following outline. No attempt has been made to indicate the relative importance of the several items.

TABLE 1
Sources of Error in the Reid Vapor Pressure Method

A—Assembled Bomb:
1. Leaks in assembly.
2. Variation in ratio of air chamber to gasoline chamber volume.
3. Errors in the pressure gauge.
4. Errors in reading the pressure gauge.

B—Condition of Sample before Test:
1. Vapor losses during handling.
2. Degree saturated with air.
3. Temperature of sample when poured into gasoline chamber.

C—Conditions of Bomb before the Test:
1. Temperature of air chamber.
2. Lack of water in air chamber.
3. Residual gasoline in the pressure gauge Bourdon tube.

D—Conditions During the Test:
1. Temperature of water bath.
2. Time and agitation used to obtain equilibrium.

The individual items in the above table are separately discussed in the following sections. In each case an attempt is made to demonstrate the actual magnitude of the errors arising from the various sources.

Description of the Reid Vapor Pressure Apparatus and Test

A short description of the Reid vapor pressure test is included at this point for the convenience of those not familiar with the test. The determination of the true vapor pressure of gasoline is not a particularly easy task for two reasons. In the first place, gasoline is a mixture of many compounds varying from very volatile to relatively involatile hydrocarbons. For this reason true vapor pressure measurements must be made by some method that will remove practically none of the constituents through vaporization during the test. Any vaporization occurring removes a portion of the most volatile compounds from the liquid without greatly effecting the less volatile compounds. The residual liquid thereby has a different composition and vapor pressure than the original sample. However, if a vapor pressure determination is attempted with practically no vaporization, another difficulty arises. Gasoline is ordinarily stored in contact with air and in time becomes appreciably saturated with air. A small amount of temperature rise will drive part of this air from solution thereby giving the effect of initial vaporization. Since the ordinary definition of vapor pressure is that pressure at which initial vaporization takes place for a given temperature then the conditions at which this apparent initial vaporization due to the air takes place would be interpreted by this definition as the vapor pressure. In fact, strictly speaking, it is the vapor pressure of the air gasoline mixture but not of the gasoline itself. If an attempt is made to remove this air by boiling away part of the gasoline, then the vapor pressure of the resulting residue is not that of the original gasoline although the dificulties due to the air have been eliminated. The Reid vapor pressure method was devised to overcome these difficulties. As shown later in the article the difficulties due to dissolved air are successfully surmounted. Some vaporization of the sample takes place during the test but for most gasolines no serious error is introduced from this source.

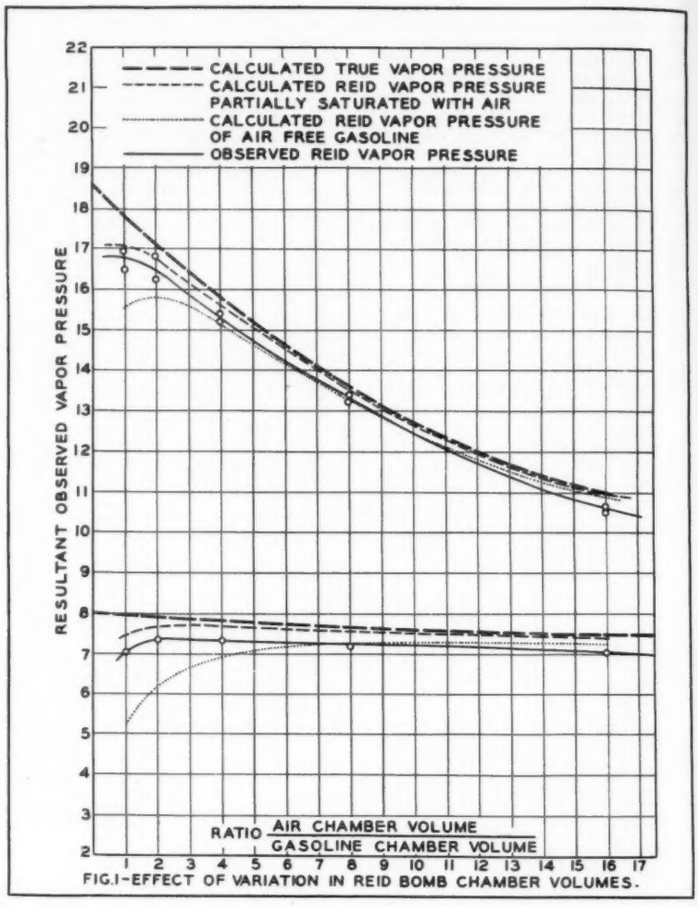

FIG.1—EFFECT OF VARIATION IN REID BOMB CHAMBER VOLUMES.

Bomb Described

The Reid vapor pressure bomb consists essentially of three parts, a pressure gauge, a gasoline chamber and an air chamber. The gasoline chamber is a metal vessel of 100 c.c. capacity which can be attached, usually by a short pipe nipple, to the bottom of the 400 c.c. capacity metal air chamber. The pressure gauge is screwed into the top of the air chamber. Previous to test, the gasoline chamber is filled with the gasoline to be tested at a temperature of 32 to 40°F. The air chamber, with the pressure gauge attached, contains air saturated with water vapor at approximately room temperature. The two chambers are screwed together, vigorously shaken and then immersed in a 100°F. water bath. The assembled Reid bomb remains in this water bath, except when removed several times during the test for shaking, until the reading of the pressure gauge becomes constant. This pressure gauge reading, after being corrected for gauge errors and the increase of the pressure of the air and water vapor in the air chamber due to temperature increase, is the corrected Reid vapor pressure. The corrected Reid vapor pressure is in most cases very close to the true vapor pressure of the gasoline when true vapor pressure is expressed in terms of absolute pressure. The so-called gas laws of physics state that the pressure exerted by any gas or vapor in a mixture of gases or vapors is the same as the pressure that gas would exert if it were present in the same volume as that of the mixture without the other components of the gaseous mixture. The air chamber of the Reid bomb contains at the end of the test a mixture of gasoline vapors and air. The pressure of the air alone was originally atmospheric. The gas law tells us, that, since the air occupies the same volume, the partial pressure (neglecting temperature effect) must still be atmospheric. During the test, enough gasoline has vaporized to cause the partial pressure of the gasoline vapor in the air chamber to become equal to the vapor pressure of the residual gasoline. The total pressure of the air and vapor in the air chamber is equal to the sum of the partial pressures of the air and vapor. The pressure gauge registers only the pressure greater than atmospheric. Since the partial pressure of the air is atmospheric the pressure gauge reading must be the partial pressure of the gasoline which in turn is equal to the vapor pressure of the residual gasoline. Therefore, the reading of the pressure gauge on the Reid bomb is the vapor pressure of the gasoline expressed in absolute pressure.

Leaks in the Assembled Bomb

It will be readily admitted that any leak in the assembled apparatus will give rise to a greater or less error, depending on the size leak, in the vapor pressure being determined. Leaks should never be permitted and perhaps should be dismissed from the discussion without further consideration. However, certain misconceptions regarding the relative seriousness of leaks should be corrected in order to guard against laxness at the very time when leaks are most serious. The usual attitude among careless testers is to exercise considerable care in correcting leaks when testing high pressure gasolines but to neglect them with rather low pressure products. The assumption that small leaks will not greatly affect results on low pressure products but are serious with high pressure products is entirely at variance with the

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truth. To illustrate this point, assume a leaky bomb is used to test several vapor pressure gasolines in order to determine the relative effect of the leak on the resultant indicated vapor pressures. To simplify the case, assume that the relatively small loss of vapor will not appreciably change the vapor pressure of the residual gasoline. (This assumption is justified for most gasolines). Further, assume that the leak is of such nature and size that 20 c.c. of air and vapor mixture are lost during a 25-minute interval used to complete the test when the pressure on the bomb is five pounds gauge. The ordinary orifice formulas show that the flow of gas through an orifice is approximately proportional to the square root of the pressure drop. Table 2 shows the calculated effect of the leak on the vapor pressures of several gasolines.

This table shows that the absolute effect of a certain leak on the vapor pressure is nearly the same regardless of the vapor pressure of the product tested and that the percentage or relative effect is greater the lower the vapor pressure of the product. Extreme care must be exercised in preventing leaks when testing low pressure products; first, because leaks are not so noticeable; second, because of the relatively greater effect on the vapor pressure of such products. Liquid leaks will have the same relative effect as vapor leaks.

TABLE 2.—RELATIVE EFFECT OF A DEFINITE LEAK ON THE VAPOR PRESSURE OF SEVERAL GASOLINES

Vapor pressure of gasoline, lb.	5	10	15	25
Square root of vapor pressure	2.236	3.162	3.873	5
Proportionate volume of leak	20.0	28.3	34.6	44.7
Per cent air in vapor-air mixture 100 (14.7/total pressure)	74.7	59.5	49 5	37 0
Proportionate volume of air lost	15.0	16.8	17.1	16.5
Reduction of indicated vapor pressure, lb. $\left(\frac{\text{volume of air}}{400} \times 14.7\right)$	0.55	0 62	0.63	0.61
Percentage error in determined vapor pressure	11	6	4	2.4

Variation of the Ratio of the Air Chamber Volume to Gasoline Chamber Volume

Considerable experimental work was done at the time the Reid method was adopted to determine the effect of variation in the ratio of the air chamber to the gasoline chamber volume. The results of the experiments indicated that a four to one ratio gave the most consistent and reasonable results. The reason for this was not clearly understood at the time. It was easy to see that a large air chamber would cause excessive vaporization of the gasoline thereby giving low observed vapor pressures. The lowering in the pressure is dependent on the nature of the gasoline so that some gasolines would show large discrepancies between their true vapor pressures and their Reid vapor pressures determined with a large air chamber while others showed but little differences. The goal of any testing method is of course the determination of the properties of the original material, not the residue left after losing part of its substance. Upon this basis alone it would appear that the smaller the air chamber the more nearly the observed vapor pressure would approach the true vapor pressure. Early work on the Reid method did not bear this out. Small air chambers gave erratic results. Frequently the observed pressure with small air chambers was less than that with larger air chambers. The reason for this contradictory performance was not clear at that time. The general conception was that heating the gasoline would drive air from the gasoline solution. That is, the solubility of air in gasoline was supposed to be dependent upon temperature. Later work on air solubility showed that the solubility of air in gasoline is dependent on partial pressure of the air and the nature of the gasoline but not at all on temperature.[1] This conception of air solubility easily explains the peculiar results obtained with small air chambers.

The partial pressure of the air in contact with gasoline is equal to the total pressure (usually atmospheric) minus the vapor pressure of the gasoline. The vapor pressures of gasolines vary with the temperature so that at high temperatures there will be little or no air in solution while at low temperatures the gasoline may contain nearly enough air to saturate it with air at a partial pressure equal to atmospheric. The partial pressure of the air in the upper chamber of the Reid bomb is presumed to be at atmospheric or slightly above during a test. However, if the gasoline being tested contained but little air at the beginning of the test, air will be absorbed from the air chamber until the partial pressure of the air in solution is equal to the partial pressure of the air in the vapor phase. According to reference[1] the amount of air absorbed by an air free gasoline may amount to 20 to 25 c.c. per 100 c.c. of gasoline. This amount of air is an appreciable proportion of that contained in a small air chamber but insignificant in a large air chamber. Since the partial pressure of the air in the air chamber is reduced in proportion to the percentage of the air absorbed by the gasoline, the resulting observed vapor pressure will be low by an amount equal to the reduction in the partial pressure of the air. For instance, assuming that the amount of air absorbed is 20 c.c. and the partial pressure of the air originally 14.7 pounds per square inch, then a Reid bomb with a 1/1 ratio of air to gasoline chamber will suffer a reduction of

$$\left(\frac{20}{100} \times 14.7\right)$$

or 2.9 pounds; a 2/1 ratio,

$$\left(\frac{20}{200} \times 14.7\right)$$

or 1.5 pounds; a 4/1 ratio

$$\left(\frac{20}{400} \times 14.7\right)$$

or 0.7 pound, and so on.

Figure 1 shows the effect of varying air to gasoline chamber size both from the standpoint of air adsorption and vaporization losses. The two gasolines studied are of extreme types. The upper curves represent a heavy gasoline containing an abnormal percentage of propane (about 5 per cent). The lower curves represent a well stabilized aviation type natural gasoline. The solid curves and circles represent the experimentally determined Reid vapor pressures with 1/1, 2/1, 4/1, 8/1 and 16/1 ratios of air to gasoline chamber sizes. The heavy dashed curves represent the calculated pressures assuming complete saturation with air at the prevailing atmospheric pressure. The light dashed curve represents the calculated pressures assuming air saturation at the conditions at which the samples were handled preliminary to testing (32 to 40°F.). The dotted curve represents the calculated pressures assuming that the gasoline contained no air preliminary to testing. These calculated curves were calculated by Raoult's law, the composition of the gasoline (by analysis) and by data from reference[1] Raoult's law is not exactly correct for this purpose which, with possible inaccuracies in the analyses, probably explains the failure of the light dashed curves to coincide with the experimental curves. Theoretically they should but in both cases they are removed a consistent amount from the experimental curves.

Figure 1 explains the erratic results obtained at low air to gasoline chamber rations and also shows that at 4/1 ratio this pronounced effect of air absorption has been appreciably corrected. The curves for the well stabilized gasoline show that variation in the air chamber size has little affect upon the observed vapor pressure outside of the air absorption effect. The abnormal heavy gasoline shows an effect of about 0.25 pound for a variation of 3.8 to 4.2 in the air to gasoline chamber size. That is, the specified permissible variation in the Reid bomb sizes will not introduce more than 0.25 pound variation in the most abnormal fuels. This amounts to 1.6 per cent. All normal gasolines and blending stocks will show considerably less variation than this. It may be safely said that the permissible variation in the Reid chamber sizes will never introduce an error greater than 1.6 per cent of the observed vapor pressure.

Errors in the Pressure Gauge

Pressure gauge errors may be eliminated by calibration of the gauge at the observed pressure reading after each test. This should always be done if accurate results are desired. Ordinarily pressure gauges are calibrated at one point only or at best at several points once every week or month or at irregular periods. Frequently gauges are never calibrated but are used as received from the maker with the assumption that they are correct. Not even new pressure gauges can be trusted. They may easily lose their factory adjustment through jarring during shipment and handling. The very best pressure gauges on the market show deviations throughout their scale reading, being correct at some readings and slightly incorrect at other readings. One such new gauge was calibrated against a mercury column to demonstrate the presence of these inconsistencies in even the best gauges. The results shown in Table 3 were obtained.

TABLE 3.—PARTIAL CALIBRATION OF A NEW 45 POUND TEST GAUGE

Gauge reading	Pressure by mercury manometer	Gauge error
0.0	0.0	0.0
5.0	5.1	—0.1
10.0	10.1	—0.1
15.0	15.0	0.0
20.0	19.9	+0.1
25.0	24.8	+0.2

The errors on this gauge are small as should be expected in a new gauge of the best quality. However, they are large enough to introduce an error of about 1 per cent in the observed vapor pressures if the gauge were used without calibration or if used with a single calibration point. In fact a single calibration point at 25 pounds would introduce a 3 per cent error in the vapor pressure

[1] Properties of Gasoline with Reference to Vapor Lock. Bridgeman and Aldrich. Journal of the Society of Automotive Engineers, p. 93, No. 1, Vol. 27 (1930).

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Errors in Reading Pressure Gauges

The errors or discrepancies occurring in reading pressure gauges are of two types; one due to reading the gauge at an angle introducing the parallax error, and the other through failure to correctly estimate the position of the gauge hand when it happens to rest between the dividing lines of the dial scale. The first error due to parallax should never be made since every laboratory worker has had occasion to observe the very appreciable apparent displacement of scale divisions on thermometers, gauges and other similar devices when observed from an angle oblique to the principle plane or axis of the instruments. However, Reid water baths are frequently placed so low that the person reading the gauge must stoop to look squarely at the pressure gauge dial without lifting the bomb from the bath. This feature is almost sure to introduce greater or less parallax errors merely because of the inconvenience involved in correctly reading the gauge. The needle of the 45 pound test gauge described in the previous section was situated about 0.1 inch above the dial face. The least divisions on the dial were 0.2 pound and were about 0.05 inch apart. Reading the pressure gauge at a 10° angle would introduce an error of about 0.07 pound, at a 20° angle, 0.15 pound, and at a 45° angle 0.40 pound. Reading a pressure gauge at an angle is inexcusable. A careful tester should never make this error.

The second error in reading pressure gauges is directly affected by the value of the smallest subdivision of the dial scale. These subdivisions on test gauges are usually fairly close together so that the maximum error likely to be made when the gauge hand rests between two lines is small. This error is probably about 1/2 a minor scale division or in the case of a 45 pound gauge about 0.1 pound. The equivalent error on gauges covering other pressure ranges will be a proportionate amount. A 45-pound gauge should be used for gasolines of 20-35 pound vapor pressure. The probable error in reading the gauge is then about 0.5 per cent for a 20 pound gasoline. Since the same error occurs in calibrating the gauge, the total probable error amounts to about 0.7 per cent. This error should be about the same regardless of the vapor pressure of the gasoline tested providing a gauge with a suitable range is used in each case.

Vapor Losses During Handling

The most recently accepted procedure for the Reid vapor pressure test strictly limits vapor losses during the sampling period. During the sampling from tank cars and open containers the sample container is filled beneath the surface of the liquid where there is no chance of vapor losses. Twenty per cent of the contents of the sample container are then poured off and the sample sealed. During this process, no vapors should be lost since vapors should not leave the container while the excess liquid is being poured off. The sample therefore reaches the laboratory without having suffered any vapor loss during the sampling. The same conclusion applies to samples taken under pressure. Whatever vapors might be lost from the first liquid entering the sample container are of no account since the liquid from which these vapors come is entirely replaced by fresh liquid during the period of flushing the container with more than twice the volume of gasoline held by the container. Low pressure samples taken from closed containers might conceivably suffer some vapor loss during the sampling period. The sampler, because of inconvenience, may not flush the container with excess sample so that the resulting sample may contain some liquid from which vapor has been lost. The maximum possible loss through this source may be estimated. For instance we may assume that the product being sampled is of 15 pounds vapor pressure and that the sampling temperature is at the upper accepted limit, 40°F. Further, we shall assume that the sample container holds no vapor at the beginning of the sampling period and that all the air in the container is forced out in such a manner as to become saturated with the gasoline at 40°F. Fifteen pound gasoline has a vapor pressure of about 4.8 pounds at 40°F. This means that every volume of air saturated with this gasoline at 40°F. would contain $\left(\frac{4.8}{14.5-4.8}\right)$ or 0.495 volumes of gasoline vapor (atmospheric pressure 14.5 pounds). Since the volume of air forced from the container equals the volume of gasoline then 0.495 volumes of gasoline vapor are lost for every volume of gasoline sample. This is equivalent to about 0.15 per cent loss by liquid volume. Apparently, the absolute maximum vaporization loss that could occur during sampling by a reasonably careful operator would be not more than 0.15 per cent.

There should be no vapor loss during storage of samples before the test. The samples should be stored in sealed containers and all samples showing evidence of leaks should be discarded.

Taking Samples

Prior to the vapor pressure determinations, the samples are cooled to 40°F. before opening. The containers should then be opened momentarily and resealed. If samples are taken at temperatures above 40°F. no vapor should escape when the samples are opened but, rather, air should be drawn in. However, the samples were originally taken with 20 per cent outage so that the gasoline will have vaporized sufficiently to saturate this 20 per cent vapor space. Using a most extreme case as an illustration shows that a 35 pound gasoline at 40°F. would have a vapor pressure of about 12.2 pounds thereby giving $\left(\frac{12.2}{14.5}\right)$ or .84 volumes of vapor for every volume of vapor space or $\frac{.84}{4} = .21$ volume of vapor per volume of gasoline. This

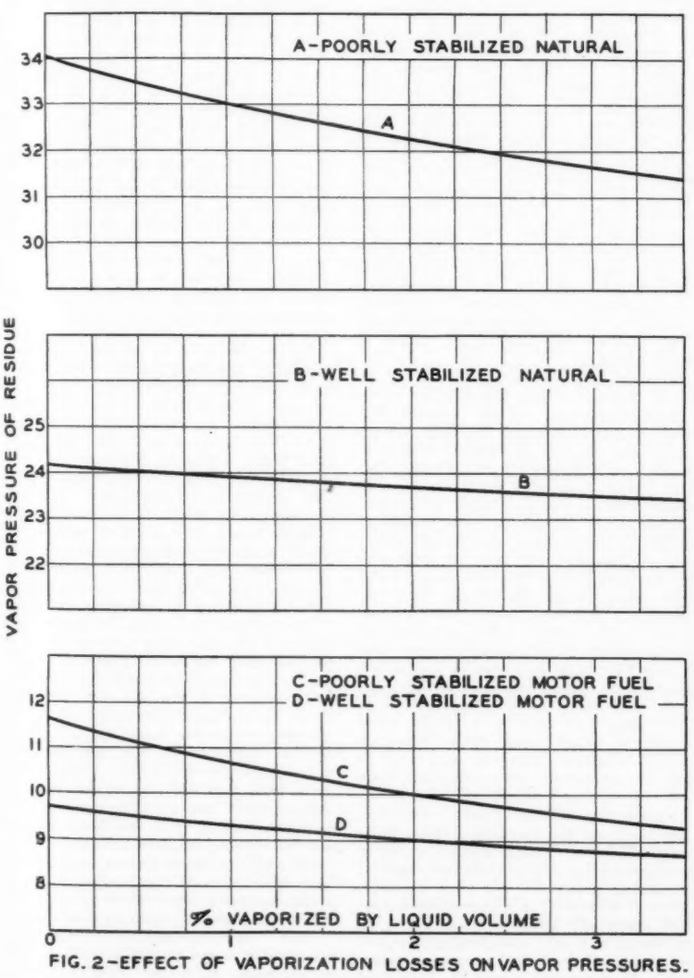
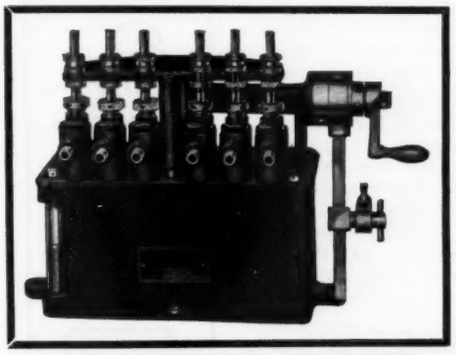


FIG. 2—EFFECT OF VAPORIZATION LOSSES ON VAPOR PRESSURES.

LUBRICATORS *for* REFINERIES

HILLS-McCANNA Models "MB" and "ET" Lubricators are ideally suited for lubricating refinery equipment. They are built to last; are simple and easy to install and maintain.

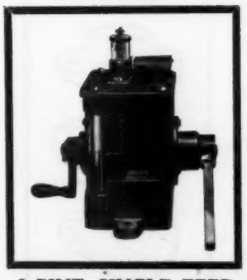
The "MB" type has all its working parts above the reservoir. It has a one-piece pump valve, and operates on the single plunger pumping principle with packed stuffing box and ball valves, the most efficient method known for pumping and proportioning liquids.



6 PINT, SIX FEED, TYPE "MB" CLUTCH DRIVEN LUBRICATOR

Blinker or glycerine sight feeds can be placed in the delivery line to indicate oil on its way to points requiring lubrication.

The "ET" Model, Type "SF" has a built-in drip sight feed on the discharge side of the pump. All working parts are enclosed in the reservoir and operate in a bath of oil. The one-piece, forged pump valve with a single plunger and ball valves, insures accurate and continuous delivery of oil to points requiring lubrication.



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The silent, vibrationless clutch which drives all Model "ET" Lubricators is enclosed in the reservoir and operates in oil.

The Model "ET" lubricators offered to the trade incorporate the same high standard of perfection that has made Hills-McCanna Lubricators standard equipment in power plants for the past 35 years.

REPAIRS AND STOCKS ARE CARRIED IN THE PRINCIPAL OIL FIELD CENTERS FOR YOUR CONVENIENCE. WRITE FOR THE ADDRESS OF THE STOCK NEAREST TO YOU.

Catalogs describing this equipment are available for the asking.

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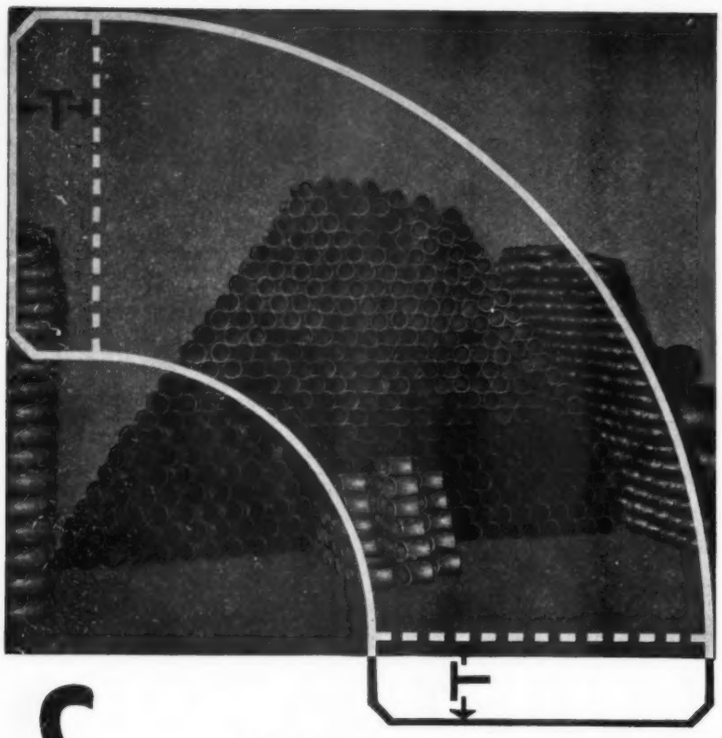


Saving 300 ft. of 6" Pipe

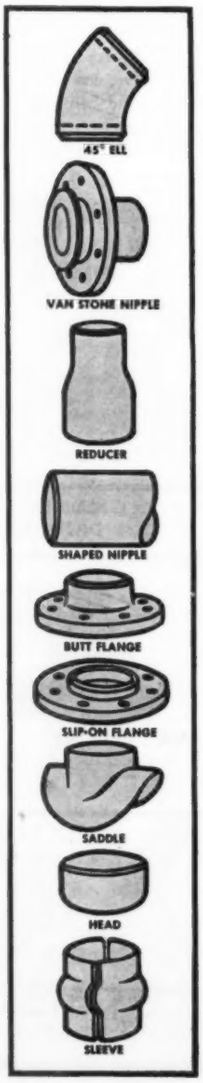
THE above photograph demonstrates one of the important advantages of the *longer tangents* available only on Midwest Ells. It shows 1200 6-inch Midwest Welding Ells in process of manufacture, each having two tangents 1½ inch long (¼ inch per inch of fitting diameter). If these ells had no tangents, the job on which they will be used would require 300 feet *more* of 6-inch pipe. The pipe saving per fitting may frequently seem unimportant, but on a project of any size it is very much worth-while.

The longer tangents on Midwest Welding Ells have other important advantages: (1) pipe and fitting are more quickly and accurately lined up; (2) clamps are easier to use than when fittings have very short tangents or none at all; (3) short nipples and the extra circumferential welds they require are frequently eliminated; (4) slip-on forged steel flanges can be welded front and back; etc.

Exceptional dimensional accuracy and uniformity are also important among the reasons why Midwest Ells are preferred by many engineers and contractors who are experienced with welded piping. The final working of the metal is in *compression* at a forging heat—it is not extruded or stretched.

Midwest Ells are also made from stainless "clad" steels, genuine wrought iron, copper, brass, Enduro, Duraloy N and other weldable alloys.

The distributor near you will be glad to supply any further information you may desire regarding Midwest Ells or the other Midwest Welding Fittings shown here.



MIDWEST

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Office

1450 South Second St., St. Louis, Mo.

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amounts to about 0.06 per cent vapor loss by liquid volume.

Reasonable care in attaching the sample transfer connection should give no occasion for further vapor loss. The sample is then poured into the gasoline chamber of the Reid bomb in such a fashion that the only vaporization occurring will be outside the sample container. The maximum loss that could then occur would amount to the vapor required to saturate the air in the gasoline chamber at 40°F. Again using the extreme 35 pound vapor pressure gasoline as an example shows that the maximum possible loss would amount to not

$$\text{more than } \frac{12.2}{14.5 - 12.2} = 5.3 \text{ volumes}$$

of vapor per volume of air displaced or 5.3 volumes of vapor per volume of gasoline or about 1.6 per cent vapor loss by liquid volume. The equivalent figure for a 15 pound gasoline would be about 0.14 per cent vapor loss by liquid volume.

Transfer Connection

The sample transfer connection referred to in the previous paragraph is a special device intended to minimize vapor losses during pouring. It consists of a screw cap or stopper, of the type used in sealing the sample containers, pierced by two tubes. One tube is long enough to extend to the bottom of the sample container. The other tube extends just inside the stopper. The sample is poured through the short tube, the longer tube allowing air to enter the container. The shorter tube should be placed so as to introduce the gasoline at the bottom of the Reid gasoline chamber. The air contained in the gasoline chamber is thus displaced with a minimum amount of vaporization, far less than that assumed in the above example. Even the effect of this small amount of vaporization may be eliminated by the same method used in sampling from pressure containers, that is, by displacing the slightly weathered gasoline by pouring an excess of fresh gasoline.

Further loss may occur during the interval between filling the gasoline chamber and attaching the air chamber. Under ordinary conditions the time during which the gasoline is exposed should be of the order of seconds. Any losses that may occur from the small surface exposed will be small enough to neglect. Certainly the presumed losses occurring in filling the chamber are enough larger than is actually the case to take care of this small loss. The maximum losses that might occur before the final assembly of the Reid bomb are therefore $0.15 + 0.08 + 0.14 = 0.37$ per cent by liquid volume for 15 pound gasoline and $0.21 + 1.6 = 1.81$ per cent by liquid volume for 35 pound gasoline. Other gasolines will have losses in proportion to their vapor pressures. Actually losses should be much lower than this with careful handling. There is, of course no way of estimating losses through careless and incorrect procedure.

Figure 2 shows the effect of vaporization losses on the calculated vapor pressures of several typical gasolines. Curve A represents a poorly stabilized natural containing about 5.6 per cent propane. Curve B represents a well stabilized natural essentially propane free. Curve C represents a poorly stabilized motor fuel containing about 1.1 per cent propane. Curve D represents a well stabilized motor fuel essentially propane free. These curves were calculated from the analyses of actual samples. Curve A shows that the maximum loss of 1.8 per cent found for a 35 pound gasoline would give a vapor pressure reduction of about 1.7 pounds or 4.85 per cent. However, a well stabilized gasoline such as B would show 0.5 pound loss. Curve C shows that motor fuels should not lose more than 0.4 pound in 15 pounds or 2.7 per cent of the original vapor pressure. A well stabilized motor fuel such as D would lose not more than 0.15 pound for a 15 pound fuel. Ten pound fuels should lose not more than about 0.10 per cent by liquid volume under extreme cases. This amounts to 0.05 to 0.10 pound reduction in vapor pressure. The absolute maximum vapor pressure losses that could occur with careful handling in the sampling and pouring procedure are summarized in Table 4.

TABLE 4.—MAXIMUM POSSIBLE VAPOR PRESSURE LOSS IN REID SAMPLING AND POURING PROCEDURE

Vapor pressure of gasoline—	Lb. vapor pressure loss	% vapor pressure loss
35 lb. well stabilized	0.5	1.4
35 lb. poorly stabilized ...	1.7	4.9
15 lb. well stabilized	0.15	1.0
15 lb. poorly stabilized ...	0.4	2.7
10 lb. well stabilized	0.05	0.5
10 lb. poorly stabilized ...	0.10	1.0

It should be remembered that the actual losses should be considerably less than the limits given in the above table.

Degree Saturated With Air

The section dealing with the effect of variation in the ratio of the air chamber to the gasoline chamber volumes has introduced the effect of air saturation on Reid vapor pressures. The following paragraphs will be devoted to a more detailed study of this effect for the standard ratio of four to one chamber volumes. Bridgeman's work on air solubility showed that the amount of air dissolved in gasoline depended on the nature of the gasoline, as measured by its specific gravity, and upon the partial pressure of the air in the vapor phase in equilibrium with the gasoline. Motor fuels are invariably stored in tanks vented to the air so that the total pressure on the liquid and vapor in the tank is at the prevailing atmospheric pressure. The total pressure of the vapor phase will be the sum of the partial pressures of the air and the gasoline vapor in the mixture. The partial pressure of the gasoline vapor is equal to the vapor pressure of the gasoline at the particular temperature occurring. Therefore, subtraction of the vapor pressure of the gasoline from the atmospheric pressure will give the partial pressure of the air which in turn may be used to calculate the quantity of air in solution providing the liquid and vapor phases have been at a certain temperature and pressure long enough to have attained equilibrium.

The partial pressure of the air in the Reid bomb is always presumed to be atmospheric or slightly above due to the bath temperature being higher than that at which the bomb is assembled. The gasoline, however, is never saturated with air at a partial pressure equal to atmospheric but always at some lower partial pressure depending upon the vapor pressure of the fuel at the temperature at which it had last come to equilibrium with the air and vapor mixture above it. The partially saturated gasoline will absorb air in the Reid bomb until the partial pressure of the air in solution is equal to the partial pressure of the remaining air in the vapor space. The resultant reduction of the observed Reid vapor pressure below that which would have been obtained had no air been absorbed from the air chamber may be easily calculated. This has been done for several typical gasolines in Table 5. In each case the gasoline was presumed to have been originally saturated with air at the sampling temperature denoted and at a total pressure equal to atmospheric.

High vapor pressure natural gasolines are usually stored in closed tanks so that no air comes in contact with the liquid. Table 5 is calculated on the assumption that no air has contacted the 35 and 26-pound naturals until their vapor pressures have fallen below atmospheric pressure. The naturals were assumed to be in contact with air at the lower pressures.

The maximum reduction in Reid vapor pressures occurs with the naturals both because the higher vapor pressures prevent as much air originally entering into solution and because the lighter gasolines have the ability of dissolving more air than the heavier gasolines even with the partial pressure of the air equal in both cases.

Table 5 indicates that the effect of air absorption in the Reid bomb might easily be misinterpreted. For instance, a 12-

pound natural might be sampled at several temperatures for a comparative test on the effect of sampling temperature upon Reid vapor pressure. The results would show that the samples taken at the lowest temperatures had the highest vapor pressures. The obvious conclusion would be that the higher temperature samples had suffered vapor losses thereby giving low results. However, the air absorption effect might be the only factor causing the discrepancy.

Tests were run to substantiate the calculated effect of air absorption. In these tests 10-gallon drums nearly full with gasoline were heated to the boiling point and gently boiled for about five minutes. Then two samples were taken directly in Reid gasoline chambers by immersion. The usual Reid test was run on one sample. The other sample was assembled with a Reid air chamber in the usual fashion but instead of being run in a 100° F. bath was run in a bath held at about 35° F. After equilibrium had been obtained at this condition the air chamber was removed, a fresh chamber substituted and the Reid test completed in the usual manner at 100° F. The test on the first sample gave the Reid vapor pressure of the gasoline containing no air. The test on the second sample gave the Reid vapor pressure of the same gasoline (somewhat weathered) practically saturated with air under atmospheric pressure.

The temperature of the 10-gallon sample was reduced about 20° after the first tests. After shaking with air to saturate at this new condition the sample was again tested in the same manner. This procedure was repeated at constantly lower temperature levels until the final test was run on samples obtained at 20° F. Table 6 gives a typical series of results on a 12-pound natural.

Table 6 shows that the calculated air absorption effect corrects the observed Reid vapor pressure to a nearly constant value regardless of the sampling temperature. Both the unsaturated sample and the presaturated sample were handled in exactly the same manner up to the time the air chambers were attached so that possibility of vapor losses from the samples up to this point were equal. The rather low corrected pressures for the standard samples at the higher temperatures must have been due to some variation in the experimental procedure since the presaturated samples do not show an equivalent lowering. The presaturated samples do suffer some weathering during the presaturating period. Likewise some gasoline is lost at that time through failure of the air chamber to drain all the liquid back into the gasoline chamber before the fresh air chamber is substituted. The weathering effect was estimated to cause a 0.12-pound lowering in vapor pressure. Failure of 2 cc. of gasoline draining back to the lower chamber would cause 0.07 pound lowering in vapor pressure. The total correction of 0.19 pound was used to obtain the corrected values given in the last column of Table 6.

The above discussion on the effect of air saturation shows that considerable discrepancies in Reid vapor pressures may be attributed to this cause. Since it is not convenient nor usually possible to calculate corrections for this effect it would appear that the best method would be to either thoroughly saturate the sample with air or else saturate to some definite degree in every case before running a test. Thoroughly saturating the sample with air will involve some procedure similar to that reported for the tests to determine the effect of air saturation. Such a procedure has the advantage of extra steps in the testing process and also the disadvantage of causing some weathering of the sample before the final test. The small amount of weathering would not be serious for a well stabilized gasoline but could introduce appreciable errors in the cause of poorly stabilized gasolines.

Alternative

The alternative, that is, of saturating to some definite degree, offers considerable attraction, both from the standpoint of convenience and from the reduced possibility of vapor losses. All samples for the Reid vapor pressure test should be cooled to 32 to 40° F. before testing. If the sample containers have about 20 per cent outage, there will be considerable air in this vapor space for all but the higher vapor pressure gasolines. The sample will of course be in equilibrium with this air. Upon cooling the sample a vacuum will result which should be relieved by momentarily unsealing the container. The air drawn into the container will be sufficient in most cases to practically saturate the gasoline with air at a partial pressure equivalent to atmospheric minus the vapor pressure of the fuel at 32 to 40° F. The container should be shaken to insure equilibrium. Although the gasoline will not be saturated with air at a partial pressure equal to atmospheric it will, however, be saturated at a certain definite condition so that two laboratories testing the same sample could expect the same results regardless of the sampling temperature at the original source. Moreover, the amount of saturation will be definite for any given vapor pressure fuel so that, if it is so desired, a correction may be applied for the effect of air saturation. This method of procedure eliminates the California type bomb and the sampling of original containers by immersion of the Reid gasoline chamber. Experience has shown that the most puzzling discrepancies between results on a given gasoline have occurred where one test was run with a California type bomb or by direct immersion and a later test run on a stored sample which was cooled before testing. The stored sample, providing no vapor loss had occurred, invariably gave higher results in warm weather. During cold weather with temperatures considerably below 40° F. the reverse would frequently be the case.

A rough estimation may be made of the possible errors or discrepancies that might occur using the above method of saturating with air at 32 to 40° F. Using as the two extremes 70 per cent of the possible saturation at 40° F. and 100 per cent of the possible saturation at 32° F., and presuming saturation of the original sample at 80° F. the possible variation in observed Reid pressure due to variation in air saturation becomes 0.16 pound for 35-pound natural, 0.21 pound for 26-pound natural, 0.11 pound for 12-pound natural, 0.08 pound for 10-pound motor fuel, and 0.05 pound for 7-pound motor fuel. Apparently the maximum error is about 0.2 pound for high vapor pressure naturals and about 0.1 pound or less for low vapor pressure naturals and motor fuels.

TABLE 5—CALCULATED REDUCTION OF REID VAPOR PRESSURE DUE TO AIR ABSORPTION IN THE REID BOMB

Sampling Temp. °F.	Type of gasoline: 35-pound natural	26-pound natural	12-pound natural	10-pound motor fuel	7-pound motor fuel
100	0.98	0.94	0.72	0.52	0.32
80	0.98	0.94	0.48	0.35	0.21
60	0.98	0.80	0.32	0.22	0.14
40	0.81	0 54	0 20	0.14	0.08
32	0.70	0.45	0.17	0.12	0.07
20	0.55	0.34	0.12	0.09	0.05
0	0.34	0.20	0.07	0.05	0.03

TABLE 6—EXPERIMENTAL DEMONSTRATION OF AIR ABSORPTION EFFECT ON THE OBSERVED REID VAPOR PRESSURE

Sampling Temp. °F.	Reid vapor pressure usual method	Reid vapor pressure after saturating with air at partial pressure of approximately atmospheric	Calculated lowering of the Reid pressure in the usual method by absorption of air	Reid pressure by usual method corrected for air absorption effect	Reid vapor pressure of presaturated sample corrected for weathering losses, etc.
Boiling point	11.86	12.64	0.89	12.75	12.83
88	12.09	12.64	0.60	12.69	12.83
71	12.20	12.61	0.44	12.64	12.80
57	12.48	12 72	0.32	12.80	12.91
43	12.60	12.61	0.22	12.82	12.80
29	12.68	12.66	0.16	*12.82	12.85
20	12.74	12.59	0.13	*12.83	12.78

*Also corrected for difference in "piston effect" between these samples and presaturated samples.

TABLE 7—"PISTON EFFECT" DUE TO LIQUID GASOLINE EXPANSION

Sample pouring Temp. °F.	A.P.I. gravity of sample: 90	80	70	60
32	0.19 lb.	0.18 lb.	0.16 lb.	0.14 lb.
40	0.17	0 16	0 14	0.12
60	0.11	0.10	0 09	0.07
80	0.05	0 05	0.04	0.03

Temperature of Sample When Poured Into Gasoline Chamber

The temperature at which the gasoline chamber of the Reid bomb is filled has one other effect besides those due to air saturation and vapor loss. This is the so-called "piston effect." The cold gasoline, upon being warmed during the test, expands and compresses the air in the air chamber to some extent thereby increasing the observed pressure in proportion to the expansion of gasoline. This effect is somewhat counteracted by the simultaneous expansion of the Reid bomb. The gasoline chamber temperature rises from approximately the sample pouring temperature to 100° F. while the air chamber temperature increases from room temperature up to 100° F. The total calculated effect is shown in Table 7 for several classes of gasoline. The room temperature was assumed to be 75° F.

Table 7 shows that the piston effect is of minor importance in the case of higher vapor pressure naturals but becomes of some importance for low vapor pressure motor fuels. However, if every sample is cooled to 32 to 40° F. before pouring, this effect is of no consequence. The maximum discrepancy that could occur from this cause amounts to not more than 0.02 pound regardless of the nature of the gasoline.

Temperature of the Air Chamber

The temperature of the air chamber may be taken with an ordinary laboratory thermometer reading to 1° F. If the thermometer is left in the air chamber any appreciable length of time before assembling the bomb the indicated temperature should be within 1° of the actual temperature. Allowing one-half degree for possible inaccuracy in the thermometer gives a total possible inaccuracy of 1½° in air chamber temperatures. This is equivalent to a resultant inaccuracy in the observed vapor pressure of about 0.06 pound regardless of the vapor pressure of the fuel tested.

Lack of Water in the Air Chamber

Free water should always be present in the air chamber before assembling the bomb. This guarantees a known amount of water vapor in the contained air. The gasoline tested will frequently contain free water. The gasoline chamber, having been immersed in an ice water bath for cooling, will certainly contain free water which will vaporize during the test thereby furnishing enough water vapor in the air chamber to increase the indicated pressure by an amount equal to the vapor pressure of water at 100° F. This will be the case if the air in the air chamber contained absolutely no water vapor before the chambers were assembled. Since air normally contains some water vapor, the partial pressure of such water vapor partially cancels the increase of pressure due to the vaporization of liquid water during the test. This means that in order to accurately estimate the correction for water vapor pressure we must know the partial pressure of the water vapor in the air chamber before assembling. The easiest way to make certain of this is to thoroughly saturate the air with water vapor by means of excess liquid water. The corrections then necessary are easily calculated and for convenience are contained in the pressure correction table included with Reid vapor pressure directions. This correction table also corrects for the increase in air pressure due to temperature rise from atmospheric to 100° F.

Residual Gasoline in the Pressure Gauge Bourdon Tube

The vigorous shaking given the Reid bomb during a test invariably forces some liquid gasoline into the Bourdon tube of the pressure gauge. This liquid does not readily drain from the tube due to the restricted opening at the bottom of the gauge and the circular shape of the tube. Thus, unless special precautions are taken to dislodge this gasoline, it may be present in the gauge when the air chamber is prepared for a subsequent test. During the process of screwing the gauge on the air chamber and later while the air chamber temperature is being obtained, this residual gasoline may flow from the gauge into the air chamber. If this happens, the gasoline will partially vaporize thereby driving part of the air from the air chamber. This will introduce an error in the next vapor pressure determination in proportion to the amount of air displaced. The reason is obvious. The Reid vapor pressure method presumes that the partial pressure of the air in the bomb is atmospheric. However, if part of the air has been originally displaced by gasoline vapor the partial pressure is no longer atmospheric. The gasoline vapor displacing the air has no different effect on the resultant vapor pressure than that coming from the gasoline being tested. The result is that the observed vapor pressure is too low by an amount equal to the lowering of the partial pressure of the air.

This effect is not readily estimated since the pressure reduction is proportionate not only to the kind of gasoline coming from the Bourdon tube but also to the amount. The amount may vary from nothing to perhaps as much as 1 or 2 cc. Actual tests show very erratic results directly traceable to this cause. A few tests were run to obtain an idea of the approximate magnitude of such errors. In these tests 1 cc. of liquid gasoline was deliberately placed in the air chamber before assembly after making sure no gasoline remained in the Bourdon tube. Regular Reid tests were run without addition of the gasoline to the air chamber and with the gauge containing no gasoline. Comparison of the results gave the vapor pressure reductions shown in Table 8 due to intentional addition of 1 cc. of gasoline to the air chamber. These results are of about the same magnitude as the greatest deviations observed when the pressure gauges were not thoroughly dried.

TABLE 8—EFFECT OF ADDITION OF CC. OF LIQUID GASOLINE TO THE REID AIR CHAMBER BEFORE ASSEMBLING

Vapor pressure of added gasoline	Resultant vapor pressure reduction
1.6 lb.	0.1 lb.
5.0	0.05
6.5	0.1
10.6	0.2
18.6	0.7

Experiments have shown that this residual gasoline may be thoroughly removed from the pressure gauge by blowing out the tube with an air jet. The air should be forced into the Bourdon tube by means of a tube small enough to be inserted well into the lower end of the Bourdon. If this procedure is followed after every test no errors will arise from residual gasoline draining into the

air chamber. The remedy is so simple and efficient that it should always be used.

The effect of an incorrect water bath temperature is easily estimated. Vapor pressure curves show that gasolines change their vapor pressure about 1.75 per cent per degree temperature at 100° F. Ordinary laboratory thermometers reading to 1° F. are not satisfactory for measuring the water bath temperature. These thermometers are frequently inaccurate by as much as ½° F. and sometimes 1° F. Added to this inaccuracy is the difficulty, during ordinary routine, of reading these thermometers any closer than ½° F. This makes a total possible error of between 1 and 2° F. with a probable error of about 0.7° F. Since precision thermometers graduated in 0.2° F. are readily available in most petroleum laboratories they should be used in the Reid water bath. Use of these thermometers should make it possible to hold the bath temperature within ± 0.2° F. without undue trouble. This temperature variation will introduce a possible error of about ± 0.35 per cent in the Reid vapor pressures.

Time and Agitation Used to Obtain Equilibrium

The errors arising from not allowing sufficient time in the water bath or from neglecting to shake the Reid bomb are not of a nature to lend themselves to quantitative analysis. An experimental study was made to determine approximately the minimum time requirement for the test. In this work the rate of pressure rise in the 100° F. water bath was observed for six gasolines ranging from 7 to 14 pounds vapor pressure. In order to reduce the results to a comparable basis, the pressures were expressed as percentage of the final pressure. The samples were run in the usual routine fashion, being poured at 32 to 40° F., shaken and placed in the water bath. The initial pressures, just before placing in the bath, were observed to vary between 42 and 56 per cent of the final pressure with an average of about 46 per cent. After the bombs were placed in the bath these pressures increased so that at the end of a 11 to 12-minute period they had reached values varying between 53 and 65 per cent of the final pressure. At this time the bombs were removed from the bath, shaken and replaced when the pressures were observed to range between 97 and 98.5 per cent of the final pressure. The pressures slowly increased from this time on with no sudden jumps due to subsequent shaking. At the end of a 16-minute interval (measured from the time the bombs were first placed in the bath) the pressures averaged 97.8 per cent of the final pressure. Twenty minutes gave 99.4 per cent of the final pressure and 24 minutes gave 99.8 per cent. At 28 minutes, the operator concluded the final pressure had been reached.

These results indicate that at least 25 minutes are required to reach a pressure near equilibrium and show the prime importance of the first shaking of the bomb after being placed in the water bath. The results indicate that if the bomb is not shaken at all after being placed in the bath, the pressures will reach an apparently constant value somewhere between 60 and 70 per cent of the equilibrium pressure at the end of a 30-minute interval. Operators should take particular precautions to prevent this when running several vapor pressures simultaneously when it is easy to overlook one of the bombs. The most likely source of error is of course in neglecting to allow sufficient time in the bath. This error may easily amount to 1 per cent since when the pressures reach 99 per cent of the equilibrium value the rate of pressure rise is very small. A 2 per cent error is too large since it indicates that the test was run in about one-half the required time.

Summarization of the Probable Errors and Discrepancies in the Reid Vapor Pressure Test

All sources of error that can be easily eliminated should be corrected by a responsible operator. These sources are leaks in the assembled bomb, errors in the pressure gauge (should be corrected by calibration for every test) and residual gasoline in the Bourdon tube. The following summarization presumes complete absence of these sources of error.

TABLE 9—SUMMARIZATION OF ESTIMATED POSSIBLE ERRORS IN REID VAPOR PRESSURE DETERMINATIONS WITH MODERATELY CAREFUL MANIPULATION

		Percentage error for typical gasolines of the following vapor pressures			
Source of error—		35	26	15	7
Sampling and pouring		3.40	2.60	1 80	0 50
Air saturation		0.46	0.81	0.87	0.71
Pouring temperature		0.01	0.01	0.01	0.03
Air chamber temperature		0.17	0.23	0.40	0.86
Bath temperature		0.35	0.35	0.35	0.35
Reading pressure gauge		0.50	0.50	0.50	0.50
Time allowed for equilibrium in the water bath		1.00	1.00	1.00	1.00
Variation in Reid chamber volumes		1.00	1.00	1.00	1.00
Total possible error*	%	3.76	3.14	2.55	1.97
	lb.	1.32	0.82	0.38	0.14

*Square root of the sum of the squares.

Further this summarization presumes that sampling shall be by the best accepted procedure with the possible deviations required to cause the errors estimated in this article, that the samples shall be cooled to 32 to 40° F. before pouring, that a precision thermometer reading of 0.2° F. shall be used in the water bath and that the bomb shall be left in the water bath at least 17 to 20 minutes. Table 9 summarizes the possible errors.

It is to be understood that Table 9 is a summarization of maximum errors. It has been demonstrated within the body of the article that sampling and pouring errors can be almost entirely eliminated. If this is done, the resulting total errors vary from 1.6 per cent for 35-pound gasoline to 1.9 per cent for 7-pound gasoline. Reid vapor pressure determinations made with every precaution observed should check within 2 per cent. Whenever tests on duplicate samples are found to deviate more than 2 per cent special attention should be directed to the testing procedure used with the view of correcting probable faults in procedure.

Research in Synthetic Lubricants Encouraged

(Continued from Page 83)

more saturated in character and more closely resemble petroleum oils.

Condensation Compounds

Introduction of paraffinic side chains into aromatic hydrocarbons such as naphthalene, results in the formation of viscous alkylated aromatics, which have been suggested as suitable for lubricating purposes. As would be expected from their pronounced cyclic (and aromatic structure), these oils possess high viscosities for a given molecular weight and boiling range, together with poor viscosity temperature characteristics, unless long paraffin side chains are present. Such oils, while having good viscosity indices, show a tendency, it has been stated, towards a high pourpoint.

Introduction of paraffinic side chains into aromatic molecules may be carried out by the well-known Friedel Crafts synthesis, in which the aromatic compound is treated with a chloro paraffin in the presence of aluminium chloride or other suitable catalyst. To avoid polymerization and cracking, the use of comparatively low temperatures is of importance. The reaction is applicable to a wide range of aromatic compounds including low temperature and other tars, aromatic fractions from petroleum oils, such as solvent extracts, together with petroleum oils of naphthenic rather than aromatic characteristics. The condensation of a wide range of chlorinated petroleum oils and fractions with various aromatic hydrocarbons is described in a very comprehensive patent held by the I.G. Farbenindustrie A.G.[11], an example being the production of a lubricating oil from the condensation of chlorinated benzines with an aromatic middle oil.

This type of synthesis is exemplified by the well-known production of "Paraflow" through the condensation of a chlorinated paraffin wax with naphthalene or other aromatic hydrocarbon in the presence of aluminum chloride[13]. The resultant oil, separated from the kerosene diluent, sludge and wax, has proved of considerable value as a blending agent for lowering the pourpoint of wax bearing lubricating stocks. The action has been attributed to a physical alteration in the type of wax crystals, leading to reduction in crystal size and dimunition in the degree of adsorption, and is of particular interest in that the Paraflow itself has a comparatively high pourpoint. This product is probably the first synthetic oil to have found extensive commercial application and, it is of interest to note, may be used for increasing the viscosity index of non-paraffinic oils by the addition of paraffin wax—to increase the V.I.—and Paraflow to maintain a low pourpoint.

A closely similar type of reaction is provided by the direct condensation of olefins with aromatic hydrocarbons in the presence of aluminium chloride or other suitable catalyst. Passage of ethylene under pressure into benzene or naphthalene, with aluminium chloride at elevated temperatures, leads to the formation of ethylated benzenes and naphthalenes. The reaction, as in the previous instance, is applicable to other aromatic hydrocarbons and oils, including partially hydrogenated naphthalenes, etc., and to other gaseous olefins a considerable number of patents having been taken out in connection with this type of reaction. Schildwachter[14] has described the properties of lubricating oils from the condensation of ethylene with naphthalene and tetralin in this manner; as would be expected, the viscosity temperature characteristics were poor, the viscosity index being of the order of —100, although some improvement was effected by subsequent voltolization treatment of the oils.

Hydrogenation of Tars

The technical production of motor fuels from the hydrogenation of coal and tars is now an entirely practicable process, but the production of lubricating oils through this reaction has so far been unsuccessful. The heavier oils from the hydrogenation of coal are of pronouncedly phenolic character, while the hydrocarbon constituents appear to belong to the polynuclear type. Such hydrocarbons differ widely from their natural petroleum analogues, possessing high viscosities and gravities with comparative instability towards heat. Furthermore intensive hydrogenation results in their molecular disintegration with formation of comparatively low boiling products.

Low Temperature Carbonization

Numerous attempts have been made towards the utilization of the viscous high boiling fractions from low temperature carbonization tars as lubricants, and such oils, produced by high vacuum distillation, have actually been marketed in Germany. These low temperature tar oils are, however, of markedly inferior properties, showing poor viscosity temperature characteristics and low resistance to oxidization and sludging. It appears that such oils need extensive further treatment, as described elsewhere, before a reasonable degree of stability is secured, and it is questionable even then whether their properties will approach those of natural petroleum lubricants.

Hydrogenation of Petroleum Oils

The improvement in stability and viscosity relationships of unsaturated and aromatic hydrocarbon oils, through hydrogenation to more stable naphthenic oils, has been mentioned. The commercial application of this has been realized through the work of the Standard Oil Development Co., and hydrogenated paraffin type automobile lubricating oils have been in commercial production for some years. The process involves high temperature and high pressure hydrogenation in the presence of sulphur resistant catalysts and is normally applied to good quality paraffin base stocks. The resultant lubricants show high viscosity indices and flashpoints with remarkably low carbon formation and freedom from sludging. The process is stated to be equally applicable to low grade oils with a similar degree of improvement in properties of the resultant oil.

Conclusions

It will be seen that the subject of the production of synthetic lubricating oils has been and is being approached from several points of attack. Advancement in petroleum testing technique, leading to appreciation of the importance of viscosity temperature characteristics and oxidation stability in the evaluation of lubricating oils, has shown that many viscous oils, which in the past have been described as lubricating oils, have in reality little value as such, particularly when used under modern service conditions. The demand for higher grade lubricants necessitated by modern engine design, is reflected in the processes suggested for synthetic lubricating oil production. It would appear that only those processes capable of producing exceptionally high grade oils or products of value for blending with petroleum lubricants, will receive serious attention as justifying the complex technique usually necessary.

The future of synthetic lubricating oils is dependent upon economic factors controlling the availability of petroleum lubricants, upon the existence of readily available basic material for the synthetic processes, and upon the demand for such distinctive lubricant properties as may be more readily supplied through use of synthetic products. That this latter factor has received considerable attention of late is exemplified by the numerous existent patents claiming the production of blending agents for the improvement of such properties as the pourpoint, viscosity index, oiliness, and oxidation stability of petroleum lubricating oils. Advance in our knowledge of the mechanism of lubrication and of the constitution of lubricating oils will undoubtedly lead to a far better understanding of those properties necessary for a satisfactory lubricant and of the manner in which they may be attained. If synthetic products are able to supply these factors either in themselves or in the form of suitable blends, then indeed a very wide field is open to them, not necessarily as substitutes for petroleum lubricants, but as essential adjuncts to them.

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Installation-Operation of Automixer for the Blending of Lubricants

By MAURICE PARTIOT

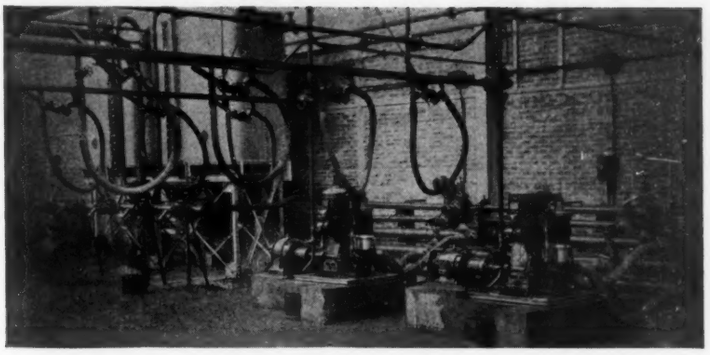


Fig. 1—Inside view of blending and filling room at a French refinery showing instant blending directly into containers from outside oil storage

The accurate and economical operation of the Automixer for blending lubricating oils depends to a certain degree upon details of its installation.

Therefore, whether the Automixer is installed in a new plant built especially for its exclusive use, or whether the Automixer is operated to supplement an existing usual blending plant, all the factors involved must be carefully taken into consideration.

In this discussion two installations are described, one of each type with an explanation of how the various problems of the blender were met in each instance.

The first installation shown is one of many in France which has been in operation for several years. With such installation, one man in many instances has turned out more than 100 drums a day of widely diversified blends, at a cost which could not be even approached through any other method.

In picture No. 1 is shown a plant in which Automixers alone are used to make all the blends for which there is a demand. Outside the building, the basic stock tanks are shown. Each of these tanks is connected with an individual line running along the well; the largest lines running near the ground carry the high viscosity stocks. In order to definitely avoid contamination, there are no manifolds. The Automixers are connected to the proper stocks through flexible oil-proof hose, terminated by a quick action coupling like the ones used on fire hose. Experience has proved that through this method losses due to contamination when changing base stocks are reduced to practically nothing.

Procedure for Definite Blend

When a definite blend is wanted, the intake of the Automixer is connected with the proper stock line; the dials are pointed to the desired proportions and the motor is started. If only a 5-gallon can or sample is wanted, the valve in front of the Automixer is opened and when the 5 gallons are almost obtained the Automixer is stopped. The last few ounces of blend are allowed to drain into the container.

If a lot including many drums is wanted, the drain valve in front of the Automixer is closed; a first drum is rolled into position and an autostop filler is placed into the opening of the drum. The Automixer is started; the next drums are immediately rolled in nearby positions and connected with autostop fillers from the same line.

While the drums are filling, the man in charge of blending attends to the fetching of empty drums, weighing and marking the drums just filled, and prepares the other Automixers for the next lots.

Only casual attention is required while the drums are filling. When all autostops are closed, the pressure backs up in the line, and shuts off the corresponding Automixer. The Automixer is then started again to top off by hand each of the drums; and the oil remaining in the line is drained off into the last drum.

Night Blending

For night blending, the discharge side of the Automixers are respectively connected to tanks which are within the building; before quitting time, the man in charge of the blending sets the Automixers to the desired percentages. In the tanks are electric level cutouts. The Automixers will automatically blend oils into their respective tanks until the adjustable predetermined levels are reached. Then they are stopped automatically. The periodical supervision of the night watchman is desirable but not necessary. In this fashion bulk blending into tanks or into tank cars is effected at a very minimum cost, which is only the cost of night rate current for pumping the oils from base tank directly into blended storage.

In changing from a blend to another, it is sometimes necessary to run from 1 or 2 gallons of the new blend to wash out the discharge manifolds. However, practice has shown this need not be done when two following blends are not very different in color or viscosities. In such cases, whatever quantity of the previous blend is clinging to the inside surfaces of the manifold discharge may be washed into the next blend, and its quantity is too small to make any appreciable difference in color and viscosity for the resulting blend.

Accordingly, the various orders are given a turn, so that they proceed in order of increasing viscosities. One Automixer takes all light colors; another one all dark colors, and for each Automixer, the color of the order will rank increasingly darker while the day advances. Also orders are given a turn so that the changes of basic stocks are as few and far apart as possible. In this fashion, practice has shown that slops and overruns are inexistant—which means a great additional saving.

In order to change from one blend to another and drain the line and the Automixer, it requires from two to five minutes. In order to change one basic stock, it requires three to four additional minutes. These figures are conservative. The study of the best possible practice in the use of the Automixer has shown the most satisfactory advantage of the method to be its flexibility—and the flexibility (otherwise saving of lost motion) is the greatest if the unit of production is not too big.

The above details show why it is much better indeed to use two Automixers than only one of double capacity. In dollars and cents, the difference in price can be amortized in about one year's time.

The second installation which is herewith described, has been made in a United States refinery with United States manufactured Automixer which includes improvements resulting from American practice. The unit has a much larger capacity than the French unit and great care was taken not to impair its flexibility and to avoid any losses due to slops incurred when changing blends.

Photograph No. 3 shows a close-up of the installation (or a close-up of the improved Automixer). Photograph No. 4 shows the Automixer in operation. Diagram No. 5 shows how the Automixer is hooked up to insure the greatest flexibility and economy of operation.

As shown in the pictures and in the diagram, the Automixer is mounted on a base of about 30 inches so that all the oil remaining in the Automixer or in the filling line may be drained to top the last drum. The improved Automixer does not include horizontal enclosures, but every element is disposed as vertically as possible so that drainage is effected in minimum time. When changing from a blend to another, drainage is effected by diverting it into the return line through the three-way valve Y.

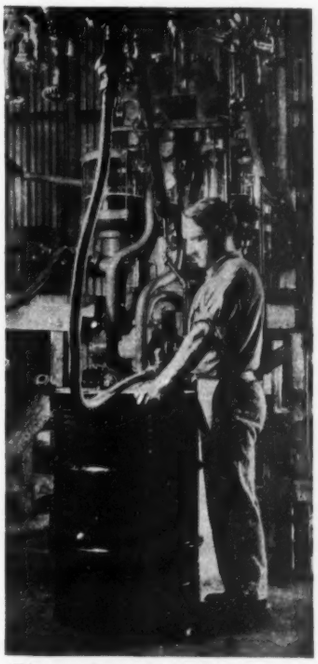


Fig. 4—The Automixer in a U. S. refinery. Operation shows simultaneous blending and filling into drums for immediate shipment

Changing Stocks

When changing from one stock to another, the installation is made so that the Automixer, through the return-line, will empty itself and send back into its respective tank the stock which is not needed any more. In order to do this, valve D is closed, petcock C is

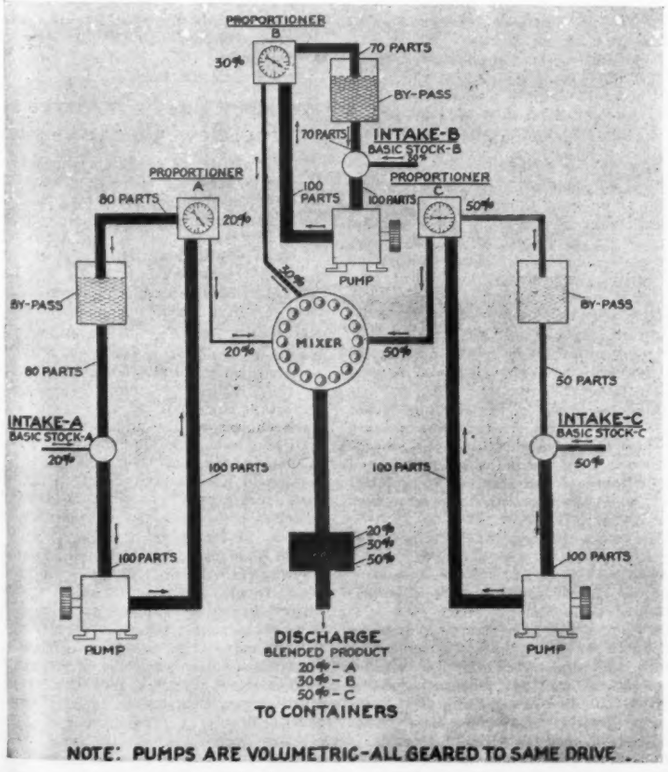


Fig. 2—Flow diagram of three base oils being blended together at the same time through Automixer in pre-determined proportions

open to let in air; then the circuit is connected with the return line through coupling B. Valve E is opened, Valve V is turned and the Automixer is then started. In less than one minute, all oil in hose A, in the by-pass and the pump has been pumped back into the main line.

Overhead and near by are smaller tanks to carry fats, lard oils, fixed oils and all ingredients that are usually added to mineral oils during the compoundings.

Also, there is a sump into which special base oils carried in stocks in drums may be emptied. When a quantity smaller than the drum is used, the whole drum is emptied in the sump, and the empty drum is then placed under the valve V. When blending is finished, the special base oil is drained back into its drums by opening the three-way valve V.

The above set-up presupposes two things, both of which are not always found in the refineries.

(a) That the stock oils are at such a level that they will flow to the Automixer.

(b) That each base oil uses an individual line thereby the base stocks are always of a well determined specification.

It must be first pointed out that these requirements are not a problem which can be specially laid to the Automixer. Modern refineries have carried out all

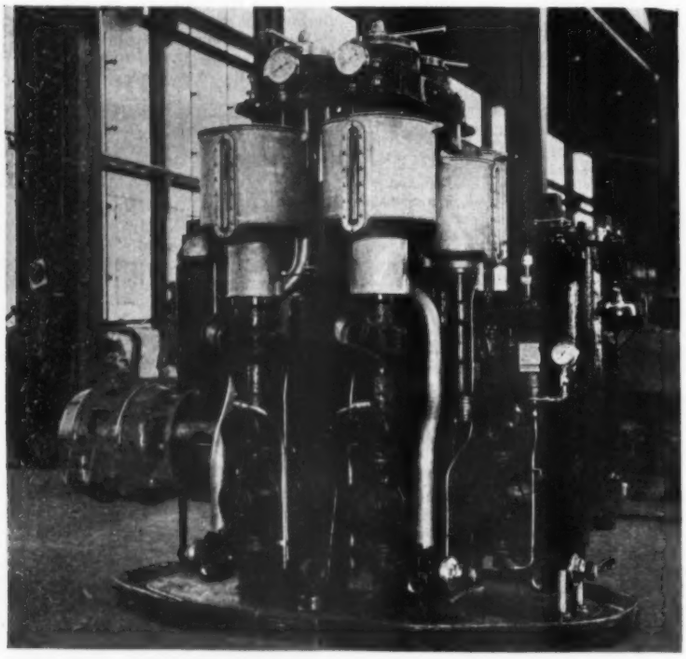


Fig. 3—Latest type of 15-bbl. per hour Automixer designed to meet all lubricating oil blending requirements in U. S. refineries

improvements towards single pumpings and gravity flow in blending and filling operations. Here are indicated the answers to this general problem of the refinery, in its relation to Automixer use.

The two requirements are obtained together through a rather simple study of the lay-out of the refinery in each instance.

In some of the refineries, the blending is now done from top to bottom of a building which comprises:

At top, special stocks—fats, fixed oils, etc.

On third floor, there are blending tanks.

On second floor, there are tanks for finished blends.

On first floor, there are the barreling and filling facilities.

In such a blending installation, there is only one pumping for each stock, and all oils are moved from the state of base oil to the state of packaged blends solely through gravity.

Sometimes blending tanks and blend storages are on the same level, all tanks being used for dual purposes. Any operator of blending equipment would like to have a layout as above described, which has a lower operating cost than other batch blending installations.

Typical Operation

In combination with such an existing installation, the Automixer will release most of the tanks which are used now for storage of blended products.

An illustration may be given in this fashion—suppose that high viscosity base stocks are designated by capital letters—A, B, C, D.

Low viscosity base stocks are designated by small letters—a, b, c, d.

Viscosities of finished blend are designated by numbers 1, 2, 3, 4.

A finished blend may therefore be thus designated—Bac3, Ad6, Dbc2, etc.

Let us say there are 10 high viscosity stocks, 10 low viscosity stocks. Let us suppose the number of different blends made monthly is 100 and that there are 25 tanks for batch making and storage of blended products. There will be say, 20 blends which will be at hand all the time, stored in blending tanks. We shall call them "privileged blends." Their designation may be Aa1, Aa2, Bb1, Bb2, Cc1, Cc2 and so forth.

All other combinations of the type Ac, Ad, etc., Be, Bd, etc., Cd, Ce, etc., in varied viscosities, will be the nonprivileged blends.

They will have to be made in the five other blending tanks, as a special batch every time there is a demand or an order for any one of the 80 non-privileged blends.

The study of the cost shows that, while the privilege blends costs little to blend, the non-privilege blends costs very much. By using Automixers in combination with the above set-up, all blends can come forth into the privileged class at a great saving of money.

Since blends Aa1, Aa2, Bb1, Bb2, etc., can be made at a moment's notice through the Automixer's use, there is no need to carry such blends in storage. Therefore, the 20 tanks previously used for storage of preferred blends can be released.

Instead of putting blends in these tanks, one shall pump into them, stocks A, B, C, etc., and stocks a, b, c, etc. Such overhead tanks will be connected by individual lines to the battery of Automixers, which are thus fed by gravity flow. When an order comes for a blend of the privileged type, it is blended immediately while packaging, at no extra cost over the usual method.

When an order comes for any one of the 80 nonprivileged blends, it can be filled right out of the overhead base stocks, by blending it through the Automixer while packaging. Thus, by using Automixers in combination with an existing installation; by rerouting the way the base oils are handled, all blends are being placed into the class of "privileged blends."

The saving is obvious: The 80 "nonprivileged" blends, although in gallonage may amount to only 15 per cent of the total volume handled, will by the usual method account for fully 80 per cent of the total costs. By using the Automixers as described, the cost per gallon of the "nonprivileged" blends will be about what such costs are now for the privileged blends made by the usual method.

The particulars given in the illustration are only indicative, and each refinery has its particular specifications. It can easily be found how, by installing one Automixer, storage tanks can be released, and how several Automixers can be finally used either by gradually working them into the plant operation or by installing them all at once.

Incidentally, the Automixers thus installed have from each overhead tank a line which contains a well defined stock. This solves the problem of bringing the base oils from large outside tanks.

Other Installations

In some older refineries, a single line of 10 is used for pumping one after the other, stocks from several tanks containing oils of nearby colors and viscosities. Now the tendency is to have an individual line all the way from the tank to the pumping station. In case of lines each serving several outside tanks, the overhead tanks will be used with the existing pumping equipment as relay in which the supply will be replenished on a very simple pumping schedule.

In some refineries, the blending is not made through gravity, but all tanks are on floor level. In such case, the storage tanks are used as indicated above, and the Automixers are placed at a lower level, while the barreling may take place at a higher level.

In other refineries, the blending plant and the stock lines are so poorly planned and so obsolete that it would not be sufficient advantage to make a combination of both.

In such a case a new layout is to be adopted from the ground up, which will permit the utmost economy in installation costs as well as in operating costs. Such layout involves feeding the Automixers directly from large base tanks scattered all over the refinery grounds.

Each tank is equipped with a variable delivery pump. The pumps automatically deliver at the Automixer the stock oils under a pressure of 5 to 10 pounds, in the variable quantities which may be drawn.

The blending machine described in the accompanying article which is known in this country as The Automixer, was invented and developed during the last few years, in France, by Paul Thiberge, technical head of Les Consommateurs de Petrole, of Paris, a large lubricating oil company. During the past two years the blending machine has been introduced in the United States and applied to American blending problems through arrangements whereby Wallace, Muller & Co., Ltd., New York City, are distributors and Maurice Partiot, consulting engineer, represents the French interests. Mr. Partiot is a member of Societe des Ingenieurs Civils, Paris, and Ingenieur des Arts et Manufactures, E.C.P. In this country Sun Oil Co. at its Marcus Hook, Pennsylvania, plant has one installation, and through arrangement a manufacturing license has been given to that company's subsidiary, Sun Shipbuilding & Dry Dock Co. A second installation of the machine is in operation at Socony-Vacuum Oil Co.'s Paulsboro, New Jersey, refinery.

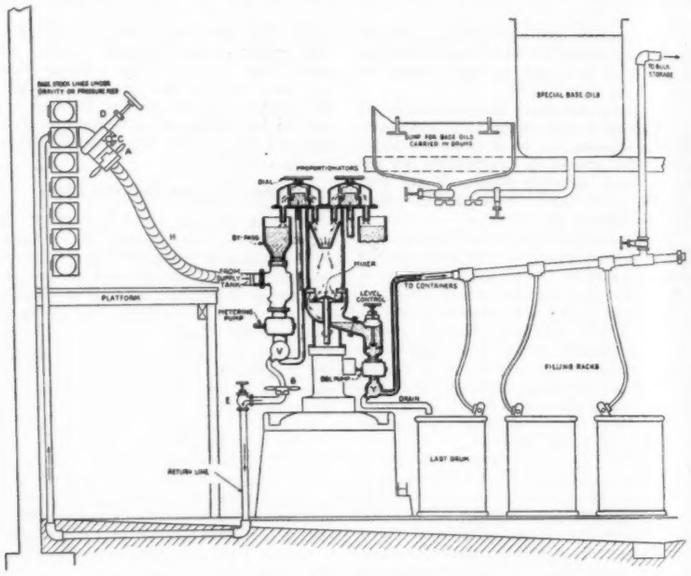


Fig. 5—Diagram of installation of Automixer as shown in Fig. 4

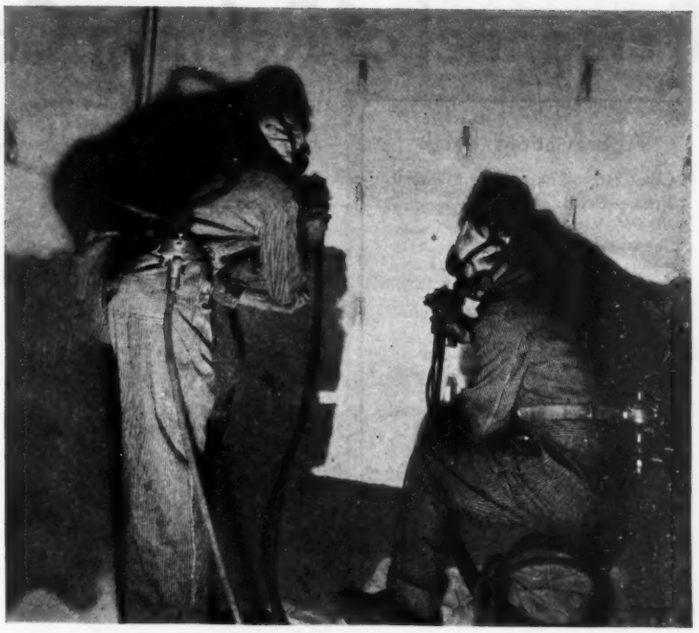
Refinery Gas Raw Material for New Chemical Plant

The Carbide & Carbon Chemicals Corp. has announced the completion of a new $10,000,000 plant at Whiting, Ind., for the manufacture of chemical products from the waste gases of the nearby refinery of the Standard Oil Co. of Indiana. A permit has been issued by the local federal alcohol tax unit for the manufacture of ethyl alcohol.

Research in chemical treatment of waste or residual gases from refineries and natural gasoline plants has resulted in the synthesis of many commercially important chemicals. A large share of the research has been conducted on the aliphatic hydrocarbons. Ethylene is the basis of many of the most useful products. The compound itself is important to growers and marketers of tropical fruits. This colorless gas speeds the natural coloring process in fruits by breaking down the green pigment, or chlorophyll, allowing the natural colors of mature fruit to appear. It also destroys by oxidation the bitter element in unripe fruit and increases the sugar content by speeding up the action of the enzymes which change starch into sugar. Ethylene is chlorinated and easily synthesized into cholene and mustard gas. Ethylene oxide is an important cello-solvent used in the dye and cellulose industries. It also finds use in lacquers and as a windshield cleaner. The carbitols are a group of aliphatic hydrocarbons derived from Ethylene, which find wide use in the cosmetic industry.

Metallizing an Important Factor in Prevention of Corrosion in Refineries

By H. R. LELAND
General Metallizing Co.



Operators lining a 10′x40′ Dubbs reaction chamber in the Kansas City, Kansas refinery of the Phillips Petroleum Co. Pure aluminum is being applied to prevent hydrogen sulphide corrosion

During the past 12 months, metallizing has become more firmly established and stabilized and those who have helped pioneer this work have been reassured by the year's results. Many of the major refinery companies who had previously withheld their support and approval are now contracting large areas to be lined with aluminum, some purchasing complete metallizing units.

The industry has offered great possibilities for applying metal linings to tanks, towers, chambers and numerous other pieces of refinery equipment to combat corrosion. The metals which have found the most ready acceptance are aluminum, where heat and sulphur cause corrosion losses, lead in vessels where acids are handled and hard steels for moving parts subject to wear such as hot oil pump plungers.

Metallizing is accomplished by spraying metal at a high temperature upon the surface. The heating is done by a reducing flame and the metal is fed into the sprayer in the form of wire. A large variety of metals can be applied by this method including aluminum, steel, lead, zinc, copper, tin, cadmium, nickel and innumerable alloys of these metals.

In this article, I shall deal briefly with some new developments in the process, its application, and the equipment which it requires, with a survey of the work done for refiners.

Early Objections Overcome

A draw back encountered in some jobs was the formation of blisters on the metallized surfaces. Contrary to general opinion, they do not occur after a year or even after a few months but almost at once. In sand blasting and preparing the surface of the shell, one must exercise great care to draw the oil from the porous sections, particularly the welds by use of a torch or other means. Even though great care may be exercised, it is impossible to catch all of them the first time. If the surface is improperly prepared the oil on the metal will expand and raise the applied coating locally. The blisters average about 1 square inch in area.

At first inspection, these raised places should be chipped off and the exposed places patched. The operation of repair is quite simple, and the expense small, making the coating good for another 6,000 hours.

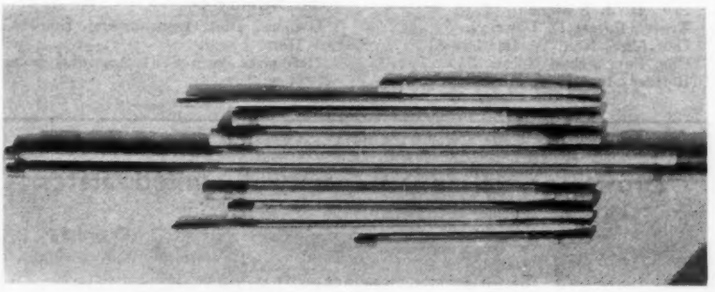
Repair Jobs

A few months ago we were summoned to repair a large bubble tower that had been completely lined with aluminum six months before. We found there were about 50 blisters inside the tower particularly along the welds. It seemed like a serious matter but in summarizing the work done, the total area repaired amounted to less than 1 square foot. The original area coated was 1,600 square feet.

In the lower section of this same tower, the coating showed much wear and streaks were worn through in certain places. This was caused by the oil flowing into the tower under great pressure. A baffle conveniently placed would have prevented this errosion.

Several months ago, one of the refineries in the Chicago district lined a number of reaction chambers with aluminum applying a layer only .004 inch in thickness. The application was entirely too thin, and the porosity which developed was a natural result. In practically all cases in the Mid-Continent Field the linings have been held to .018 inch or four and one-half times as thick. In the case of the Producers and Refiners Corp.'s test at West Tulsa, .013 inch stood up but the additional thickness is cheap insurance.

A number of chambers have been lined with aluminum at the Drumright refinery of the Tide Water Oil Co. In three of these vessels, sections of the aluminum had been dissolved and the shell exposed. Upon investigation we found the temperatures carried in these vessels was from 500 to 550°F. at which temperatures chlorides are more active and chemical reactions take place with the aluminum. Under these circumstances however a large degree of protection has been realized and by the required repairs every six months to these vessels it has been found to be more economical in the protection of these units. Only the vapor space is affected and it is this space which needs to be metallized.



Ten small plungers and piston rods rebuilt with KA2S and Monel Metal for the Cosden Oil Co., Big Spring, Texas

Work on Radiant Tubes

Considerable experimenting has been done in attempts to prolong the life of radiant tubes. The tests have met with indifferent success. Aluminum sprayed on the inside of these tubes appears to have eroded away. Some of the tubes were metallized on the outside to reduce scale accumulations. The under side only was reached when the tubes were coated in place, and up to this time no appreciable benefit has been measured. It is believed, however, that these heat and corrosion problems will some day be solved by metallizing with aluminum.

The first reaction chamber lined was a 10′ x 40′ flash tower for the Deep Rock Oil Corp. at Cushing, Okla. Six hundred square feet of surface was metallized with .018 inch of aluminum in June, 1933. Prior to this time, there had been a loss in wall thickness of 625/1,000 inch and further loss could not be surfaced. Repairs to the lining have been made twice. In the 20 months since metallizing, no measureable loss has been reported by Universal Oil Products Co., who make the inspections. I know of no better example of the economic value of metallizing to the refining industry than this. Many Dow Surge Pot Sections in hot oil pumps which have been lined with aluminum have shown no further loss in wall thickness.

In November of 1933 a new 5′ x 25′ reaction chamber was lined for the Universal Oil Products Co. and installed in a test plant at the Shell Petroleum Corp.'s East Chicago refinery. One year later the lining was inspected by officials of both companies and found to be in perfect condition except a few square feet in the neck of the manhole where improper etching had been done. This area was repaired and the chamber immediately put on stream.

Rebuilding Plungers

The outstanding service obtained from rebuilt hot oil pump plungers, is at the Tide Water Oil Co.'s refinery at Drumright, Okla. These 8½″ x 42″ plungers are water cooled, and operate in Wilson Snyder pumps. They are rebuilt by applying a coat of KA25 .070 inch thick along 36 inches of the plunger length. The first two plungers were put in the pumps August 26 and 31, 1933 and have not been taken out of service since. Sixteen of these plungers have been recovered. All now in use and reserved as standbys have been rebuilt with 18-8 alloy steel.

A large number of plungers, piston rods, pump shafts and pistons have been built up by this process during the last year. We have found an extra high carbon steel wire with a carbon content of 1.2 which is used where an exceptionally hard surface is required. The brinnell hardness is well over 400. It should be included in requisition for plungers handling oil not too corrosive and upon rods where metallic packing is used.

It will be interesting to learn of the kind and magnitude of the work contracted, where metallizing units have been purchased, and what the owners are doing with them.

The Phillips Petroleum Corp. has metallized and had metallized probably more surface (approximately 15,000 square feet) than any other oil company. One complete metallizing unit was purchased for the Kansas City refinery in May last year and two units were delivered and used in the gasoline department of the Phillips Co. at Borger, Tex., where several 10′ x 40′ horizontal gasoline storage tanks were lined with aluminum. Dephlegmators were lined in part at the refineries at Kansas City and Okmulgee.

The Continental Oil Co. refinery at Ponca City has successfully completed a number of different kinds of work and are second only to Phillips in area metallized. All of the chambers in four of their Dubbs cracking units are now lined with aluminum.

In July, 1934, the Shell Petroleum Corp. contracted its first work of metallizing at its Wood River refinery. A bubble tower in one of the Cross units was completely lined with aluminum, an area of 1,600 square feet. A large number of new chambers are now being lined by this company. One of the most interesting developments to date is the lining of these vessels before heat treatment.

Sixty days ago, the Pure Oil Co. purchased four metallizing units, for refineries located at Muskogee, Smith's Bluff and eastern locations. They plan to use these in reclaiming wearing surfaces, heat exchanger heads and the innumerable small pieces of equipment that corrode around a refinery. They expect to increase the efficiency of their suction fans and blowers by rebuilding with chemical lead. Our operators have just completed

(Continued on Page 168)

Personnel of Refining Companies in United States

Abbreviations Used:

Chm. Bd.—Chairman of Board
Pres.—President
V. P.—Vice President
Sec.—Secretary
Treas.—Treasurer
Gen. Mgr.—General Manager
Gen. Supt.—General Superintendent
Sales Mgr.—Sales Manager
Tank Car S. M.—Tank Car Sales Manager
Station S. M.—Station Sales Manager
Pur. Agt.—Purchasing Agent
Traf. Mgr.—Traffic Manager
Ch. Egr.—Chief Engineer
Supt.—Superintendent
Asst. Supt.—Assistant Superintendent
Ch. Chem.—Chief Chemist

A

Acme Refining Co., Gladewater, Tex.
Owners, J. N. Whitlock, Elbert Holmes and J. H. Talley
Refinery located at Gladewater, Tex.

Adams Refining Co., Big Spring, Tex.
Owner, A. J. Adams
Refinery located at Big Spring, Tex.

Aerex Co., Farmington, N. Mex.
Pres. and Gen. Mgr., A. C. Kittell
V. P., V. A. Kittell
Sec. and Treas., E. H. Kittell
Supt., E. H. Kittell
Asst. Supt., Gilbert Noland
Sales Mgr. and Pur. Agt., A. C. Kittell
Refinery located at Bloomfield, N. Mex.

Aetna Oil Service, Inc., 1202 South Third St., Louisville, Ky.
V. P., W. R. Abbott
Sec., W. T. Davis
Treas., W. R. Abbott
Gen. Supt., E. E. Van Buren
Tank Car S. M., H. J. Flanders
Station S. M., Julius Malkemus
Pur. Agt., E. C. Wolff
Traf. Mgr., Charles Price
Refinery located at Louisville, Ky.

Airolene Gasoline Corp., 722 Kennedy Bldg., Tulsa, Okla.
Pres., Forrest E. Gilmore
V. P., Carl W. Gilmore
Sec. and Treas., H. O. Whitfield
Gen. Mgr., Forrest E. Gilmore
Gen. Supt., Carl W. Gilmore
Asst. Supt., Jess Patterson
Pur. Agt., Carl W. Gilmore
Refinery located at Magic City, Tex.

Ajax Oil & Refining Co., 811 West Seventh St., Los Angeles, Calif.
Pres. and Gen. Mgr., E. L. Cragen
Sec., W. G. Krieger
Treas., I. G. Krieger
Supt., P. A. Lawler
Tank Car. S. M., W. E. Williams

Alamo Refining Co., Taylor, Tex.
Pres., G. L. Rowsey
Treas., Ben H. Harrison
Refinery located at Greggtown, Tex.

Allegheny Arrow Oil Co., Gambrinus Road, S.W., Canton, Ohio.
Pres., Charles W. Wild
Sec., Daniel C. Funk
Treas., Reid Brazell
Gen. Mgr., Reid Brazell
Gen. Supt., Reid Brazell
Pur. Agt., Reid Brazell
Station S. M., J. F. Kennedy
Ch. Chem., Earl F. Wittmer
Traf. Mgr., Paul T. Foust
Refinery located at Canton, Ohio.

Allegany Refiners, Inc., Bolivar, N. Y.
Pres., A. L. Shaner
V. P.s, C. A. Chipman and D. V. McCarthy
Sec. and Treas., Neil S. Sullivan
Ch. Chem., A. W. Wickham
Gen. Supt., R. G. Williamson
Asst. Supt., W. V. Paris
Sales Mgr., Harvey L. Chambers
Traf. Mgr. and Pur. Agt., Hugh J. Arnold
Refinery located at Bolivar, N. Y.

Allstate Refining Co., Rockdale, Tex.
Pres., H. H. Coffield
V. P., Geo. P. Mann
Sec. and Treas., J. H. Edwards
Gen. Mgr., G. P. Mann
Asst. Gen. Mgr., L. R. Palmer
Gen. Supt., L. R. Palmer
Ch. Chem., Martin Blackburn
Supt., Fred Green
Asst. Supt., Bill Orr
Sales Mgr., C. A. Prater
Pur. Agt., C. A. Prater
Traf. Mgr., C. J. Demmer
Refinery located at Thrall, Tex.

Alton Refining Co., Gladewater, Tex.
Owner, T. E. Patten
Refinery located at Gladewater, Tex.

American Oil & Refining Co., 5776 Cherry Ave., North Long Beach, Calif.
Gen. Mgr., A. C. Mayrowitz
Refinery located at Hynes, Calif.

American Petroleum Co., Petroleum Bldg., Houston, Tex.
Pres., Craig F. Cullinan
V. P.s, R. S. Tucker and James P. Lavery
Sec., G. L. Townsan
Treas., C. T. Carnes
Supt., R. C. Cook, Norsworthy, Tex.
Tank Car S. M., James P. Lavery
Ch. Egr., John H. Bringhurst
Ch. Chem., H. P. Sellers
Pur. Agt., J. A. McClarty
Refinery located at Norsworthy, Tex.

Amsco Refining Co., Sames-Moore Bldg., Laredo, Tex.
Pres., Kent W. Bartlett
V. P., John D. Manley
Sec., R. J. Scatena
Treas., Forest D. Lowrey
Gen. Mgr., Kent W. Bartlett
Gen. Supt., Fred Geiger
Refinery located at Mirando City, Tex.

Anderson-Prichard Oil Co., Colcord Bldg., Oklahoma City, Okla.
Pres., L. H. Prichard
V. P., J. Steve Anderson
Sec. and Treas., Paul A. Anderson
Gen. Mgr., L. H. Prichard
Gen. Supt., Geo. H. Burruss
Asst. Supt., M. B. Burruss
Mgr. Ref. Oil Sales, C. L. Mayhall
Mgr. Tech. Naphtha Sales, C. H. Dresser
Ch. Egr., Geo. H. Burruss
Pur. Agt., Wm. Sturges
Traf. Mgr., M. H. Champion
Refinery located at Cyril, Okla.

Archer Refining Corp., 801 City National Bldg., Wichita Falls, Tex.
Pres., Geo. G. Golden
Sec., J. R. Small
Supt., W. E. Hames
Gen. Mgr., Geo. G. Golden
Tank Car S. M., Geo. G. Golden
Refinery located at Megargel, Tex.

Arktex Refining Co., Kilgore, Tex.
Owner, A. B. Riley
Refinery located at Kilgore, Tex.

Arro Oil & Refining Co., 603 Montana Bldg., Lewistown, Mont.
Pres., H. H. Schwartz
V. P., E. L. Allen
Sec., Guy R. Enlow
Treas. and Gen. Mgr., E. L. Allen
Gen. Supt., Paul Jones
Tank Car S. M., T. R. Gilmour
Ch. Chem., Paul Cooper
Pur. Agts., E. L. Allen and Paul Jones
Traf. Mgr., T. R. Gilmour
Refinery located at Lewistown, Mont.

Arrow Refining & Producing Co., Fort Worth National Bank Bldg., Fort Worth, Tex.
Pres., H. B. May
V. P., O. B. Stephens
Sec. and Treas., F. H. Murphy
Gen. Mgr., O. B. Stephens
Gen. Supt., O. B. Stephens
Supt., H. L. Toups
Tank Car S. M., Henry B. May
Pur. Agt., O. B. Stephens
Refinery located at Overton, Tex.

Artex Refining Co.
Owners, Dick Duncan and Errol C. Holt
Refineries located at Arp and Longview, Tex.

Ashland Refining Co., Second National Bank Bldg., Ashland, Ky.
Pres. and Gen. Mgr., Paul G. Blazer
V. P., W. H. Keffer
Sec., E. L. McDonald
Treas., E. W. Seaton
Gen. Supt., F. W. Irwin
Tank Car S. M., E. F. Wells
Station S. M., A. A. Hines
Ch. Egr., C. C. Compton
Ch. Chem., C. O. Garbrecht
Pur. Agt., M. K. Lovell
Traf. Mgr., P. H. Banks
Refinery located at Catlettsburg, Ky.

Associated Oil Co., 79 New Montgomery St., San Francisco, Calif. (Subsidiary of Tide Water Associated Oil Co.)
Pres., Wm. F. Humphrey
V. P.s, L. F. Bayer, L. D. Jurs, B. I. Graves, J. H. Jenkins, E. L. Shea, W. A. Sloan
Sec., J. P. Edwards
Treas., W. A. Sloan
Gen. Supts., Wm. P. Hugo, Associated, Calif.; F. E. Coyle, Wilmington, Calif.
Asst. Gen. Supt., T. O. Edwards, Jr., Associated, Calif.
Supt., Frank Harris, Wilmington, Calif.
Domestic S. M., P. E. Allan
Fuel Oil S. M., E. Whitehead
Ch. Egr., H. B. Haney
Ch. Chem., L. Mittelman, Associated, Calif.; E. J. Lange, Wilmington, Calif.
Pur. Agt., A. P. MacKillop
Mgr. of Transport, H. T. Earl
Refineries—Avon Refinery, Associated, Calif.; Watson Refinery, Wilmington, Calif.

Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pa.
Chm. Bd., J. W. Van Dyke
Pres., W. M. Irish
V. P.s, W. D. Anderson, R. D. Leonard, E. J. Henry, E. R. Cox.
V. P. and Sec., W. M. O'Connor
Treas., R. H. Colley
Mgrs. Ref., H. M. Nichols, Philadelphia, Pa.; G. E. Glines, Franklin, Pa.; G. H. Weaver, Pittsburgh, Pa.; M. J. Welsh, Brunswick, Ga.
Asst. Mgrs. Ref., W. F. Stroud, Jr., Philadelphia, Pa.; B. H. Waterbury, Franklin, Pa.; R. P. Horner, Pittsburgh, Pa.; R. Stewart, Brunswick, Ga.
Domestic S. M., R. D. Leonard
Export S. M., W. D. Anderson
Ch. Egr., W. Samans
Ch. Chem., Dr. J. H. Boyd, Jr.
Pur. Agt., J. S. Parks
Mgr. Trans., R. C. Tuttle
Refineries located at Philadelphia, Pa.; Franklin, Pa.; Pittsburgh, and Brunswick, Ga.

Atlantic Gulf Refining Co., Kilgore, Tex.
Owners, G. Kelly and G. D. Moore
Refinery located at Kilgore, Tex.

B

B. & F. Oil & Refining Co., P. O. Box 1, Culver City, Calif.
Pres., N. W. Friedman
V. P., D. W. Beattie
Sec., J. S. Friedman
Treas., D. W. Beattie
Gen. Supt., H. H. Biber
Refinery located at Venice, Calif.

B. & M. Refining Co., P. O. Box 127, Roundup, Mont.
Pres., Don J. Baize
V. P., Walter W. Baize
Sec. and Treas., Lee R. Milan
Gen. Mgr., Don J. Baize
Supt., M. H. Lewis
Ch. Chem., Wm. M. Jones
Refinery located at Roundup, Mont.

Growth of Refinery Capacity in United States

Year—	Number of refineries	Total crude capacity (bbls. daily)	Number of operating refineries	Capacity of operating refineries (bbls. daily)
1914	176	.....	...	.....
1918	267	1,186,155	...	.....
1919	289	1,295,115	...	.....
1920	373	1,530,565	...	.....
1921	415	1,888,800	...	.....
1922	479	2,164,050	325	1,854,590
1924	574	3,046,790	362	2,549,490
1925	584	3,033,682	385	2,680,052
1926	515	3,068,340	356	2,770,340
1927	462	3,224,307	328	2,964,427
1928	456	3,426,330	315	3,116,930
1929	463	3,719,550	341	3,454,250
1930	479	3,972,460	362	3,721,360
1931	500	4,164,080	397	3,913,180
1932	510	4,093,370	383	3,665,830
1933	567	4,125,250	424	3,696,410
1934	628	4,243,033	483	3,790,593
1935	687	4,281,694	496	3,815,470

Bachmann Petroleum Corp., 1841 East Twenty-ninth St., Long Beach, Calif.
Refinery located at Long Beach, Calif.

Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.
Pres., Arthur W. Sewall
V. P.s, C. W. Bayliss, Frank Seamans
Sec., E. R. Riter
Treas., F. J. Robertson
Prod. Mgr., John H. Weller
Supt., Joseph Slutzker
Asst. Supt., H. J. Fleischer
Tank Car S. M., H. C. Hottel (Gen. Office)
Ch. Egr., Chas. T. McGrady, Maurer, N. J.
Director Techn. Bureau, J. S. Miller, Jr., Maurer, N. J.
Pur. Agts., John H. Weller, General Office; A. J. Hollenbach, Maurer, N. J., Local Purchases
Traf. Mgr., Joseph P. Brown (General Office)
Refinery located at Maurer, N. J.

Barnsdall Oil Co., Petroleum Bldg., Tulsa, Okla.
Pres., E. B. Reeser
V. P.s, F. E. Holsten, Geo. D. Locke, J. F. Adams
Sec., Jas. A. Dunn
Treas., C. E. Votrian
Gen. Mgr., F. E. Holsten
Supts., G. T. Granger, Okmulgee, Okla.; V. R. Oakley, Barnsdall, Okla.; Frank S. Horne, Wichita, Kans.
Asst. Supt., J. V. Brazier, Barnsdall, Okla.
Tank Car and Station S. M., J. F. Adams
Ch. Chem., E. R. Wiles
Pur. Agt., O. E. McClatchey
Traf. Mgr., R. E. Stewart
Refineries located at Okmulgee, Okla.; Barnsdall, Okla., and Wichita, Kans.

Basin Refining Co., Box 96, Aztec, N. Mex.
Owner, D. J. Lingenfelter
Refinery located at Aztec, N. Mex.

Bayou State Refining Corp., 1008 Slattery Bl'g., Shreveport, La.
Pres., Frank M. Cook
V. P., G. C. Longman
Sec., Sidney M. Cook
Treas., Frank M. Cook
Gen. Mgr., Frank M. Cook
Supt., T. N. Reed
Tank Car S. M., Douglas MacDonald
Ch. Egr., T. N. Reed
Pur. Agt., F. D. Coons
Traf. Mgr., F. D. Coons
Refinery located at Hosston, La.

Beacon Oil & Refining Co., Henderson, Tex.
Pres., T. P. Cannon
Treas., F. P. Cannon
Sec., H. W. Roberts
Refinery located at Henderson, Tex.

Beaver Oil & Gas Co., 5206 North Hopkins St., Milwaukee, Wis.
Pres. and Treas., M. E. Askotzky
V. P., J. Askotzky
Sec., J. Plotkin
Gen. Supt. and Station S. M., M. E. Askotzky
Refinery located at Milwaukee, Wis.

Bee Oil & Refining Co., Box 94, Pettus, Tex.
Receiver, W. M. Thomas
Gen. Mgr. and Sales Mgr., W. E. Stewart
Refinery located at Pettus, Tex.

Bell Oil & Gas Co., Philtower Bldg., Tulsa, Okla.
Pres., S. L. Lubell
V. P.s, Albert Finston, I. A. Anson and M. L. Freese
Sec. and Treas., Jesse Finston
Gen. Mgr., Albert Finston
Gen. Supt., Rex Young
Asst. Supt., R. V. Oder
Tank Car S. M., L. H. Deatherage
Pur. Agt., J. N. Naron

REFINERY OPERATIONS IN THE UNITED STATES SEGREGATED ACCORDING TO PLANT LOCATION

State—	No. of plants	Daily crude capacity (bbls.)	No. of plants operating	Crude capacity operating plants	No. of plants shut down	Crude capacity plants shut down
Alabama	1	6,000	...	.....	1	6,000
Arizona	1	1,090	...	.....	1	1,000
Arkansas	11	49,750	6	38,250	5	11,500
California	82	822,950	68	784,750	14	38,200
Colorado	8	6,440	7	6,380	1	60
Georgia	2	9,000	2	9,000	...	.....
Illinois	13	131,650	10	121,950	3	9,700
Indiana	8	195,750	6	192,650	2	3,100
Iowa	1	1,500	...	.....	1	1,500
Kansas	24	170,480	21	166,450	3	4,030
Kentucky	15	37,850	11	28,950	4	8,900
Louisiana	18	245,550	11	195,250	7	50,300
Maryland	4	62,000	3	55,000	1	7,000
Massachusetts	2	48,000	2	48,000	...	.....
Michigan	11	30,500	9	28,000	2	2,500
Mississippi	1	1,500	...	.....	1	1,500
Missouri	3	21,500	3	21,500	...	.....
Montana	30	36,860	24	27,610	6	9,250
Nebraska	1	75	1	75	...	.....
New Jersey	9	268,500	9	268,500	...	.....
New Mexico	12	11,550	9	7,250	3	4,300
New York	6	56,700	6	56,700	...	.....
Ohio	16	111,670	13	108,170	3	3,500
Oklahoma	65	344,020	41	269,320	24	74,700
Pennsylvania	50	312,250	41	299,600	9	12,650
Rhode Island	2	11,000	2	11,000	...	.....
South Carolina	1	6,500	1	6,500	...	.....
South Dakota	1	100	1	100	...	.....
Tennessee	2	1,000	...	.....	2	1,000
Texas	247	1,200,640	159	992,790	88	207,850
Utah	4	8,600	3	8,400	1	200
Virginia	1	2,000	1	2,000	...	.....
Washington	2	1,500	...	.....	2	1,500
West Virginia	6	17,500	5	15,000	1	2,500
Wyoming	27	49,809	21	46,325	6	3,484
Total	687	4,281,694	496	3,815,470	191	466,224

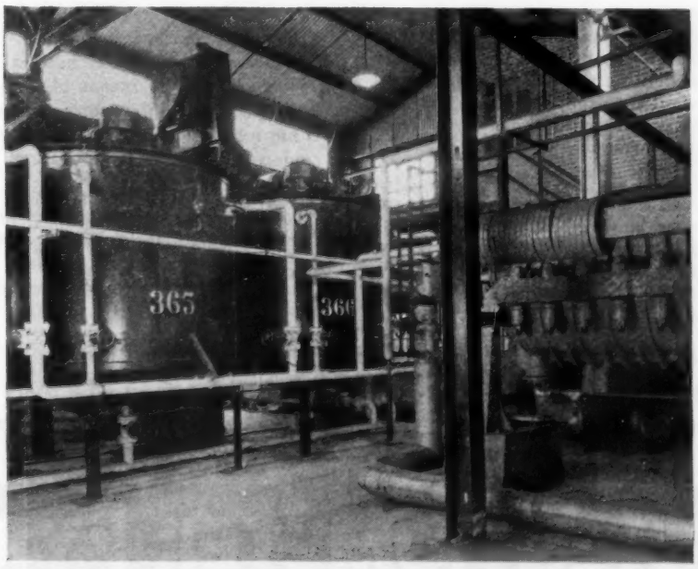
Traf. Mgr., C. E. Caddieux
Refinery located at Grandfield, Okla.

Bell View Oil Syndicate, 526 Richfield Oil Bldg., Los Angeles, Calif.
Refinery located at Santa Fe Springs, Calif.

Berry Asphalt Co., 6 North Michigan Ave., Chicago
Pres., C. E. Miller
V. P., J. D. Berry
Sec. and Treas., C. D. Berry
Gen. Mgr., Carl E. Miller
Supt., J. W. Smith
Pur. Agt., J. W. Smith
Traf. Mgr., S. H. Giesy
Refinery located at Waterloo, Ark.

Berry, James B., Sons' Co., Inc., Oil City, Pa. (Subsidiary of Quaker State Oil Refining Corp.)
Pres., James D. Berry
V. P., S. Messer
Sec. and Treas., Chas. D. Berry
Gen. Supt., G. B. Hunter
Tank Car S. M., Frank Berry
Refinery located at Oil City, Pa.

Bighorn Oil & Refining Co., East Fourth Ave., North, Billings, Mont.
Pres., Paul Stock
V. P., E. J. Fleming
Sec., Treas. and Gen. Mgr., J. G. Everett
Gen. Supt., T. R. Graham
Asst. Supt., J. E. Simon



Extract neutralizing tanks and filter press as part of equipment installed at Wellsville, N. Y. by Sinclair Refining Co. for solvent refining of lubricating oils through the use of nitrobenzol and sulphuric acid

Tank Car S. M., J. G. Everett
Ch. Chem., J. E. Simon
Refinery located at Billings, Mont.

Big West Oil Co., 617 Hutton Bldg., Spokane, Wash.
Pres., L. R. Hawley
V. P., Chas. P. Lund
Sec. and Treas., John E. Orr
Asst. Sec. and Treas., M. D. Prince
Gen. Mgr., L. R. Hawley
Gen. Supt., George Engle
Asst. Supt., Jerry Kincaid
Mgr. Sales Prom., R. I. Kerr
Ch. Chem., Dan Mullady
Pur. Agt., George Engle
Tank Car and Station S. M., Amed Soderstrom
Traf. Mgr., George Engle
Refinery located at Kevin, Toole County, Mont.

Black Gold Refining Co., 604 Commerce Exchange Bldg., Oklahoma City, Okla.
Pres. and Gen. Mgr., D. A. Corcoran
Gen. Supt., A. M. Edmiston
Sec., C. W. Scott
Tank Car S. M., C. W. Scott
Station S. M., C. H. Hunter
Ch. Chem., Fred Irby
Pur. Agt., D. A. Corcoran
Traf. Mgr., C. H. Marshall
Refinery located at Oklahoma City, Okla.

Bluebonnet Oil Refining Co., 1509 Magnolia Bldg., Dallas, Tex.
Pres., B. L. Woolley
V. P., B. W. Woolley
Sec., C. R. McClennahan
Treas., B. L. Woolley
Tank Car S. M., B. W. Woolley
Refinery located at Wickett, Tex.

Blue Diamond Refining Co., Gladewater, Tex.
Owner, C. D. Archer
Refinery located at Gladewater, Tex.

Bowling Green Refining Co., Inc., Memphis Junction, Ky.
Pres., Ben F. Medley
V. P., A. C. Deer
Sec., H. T. Downing
Treas., M. A. Arvin
Gen. Mgr., A. C. Deer
Gen. Supt. Refs., M. C. Sumpter
Asst. Supt., H. G. Taggart
Tank Car S. M., D. E. Foster, Box 605, Bowling Green, Ky.
Station S. M., D. E. Foster
Ch. Chem., M. C. Sumpter, Box 605, Bowling Green, Ky.
Traf. Mgr., T. C. Ridge, 1604 Heyburn Bldg., Louisville, Ky.
Refinery located at Memphis Junction, Ky.

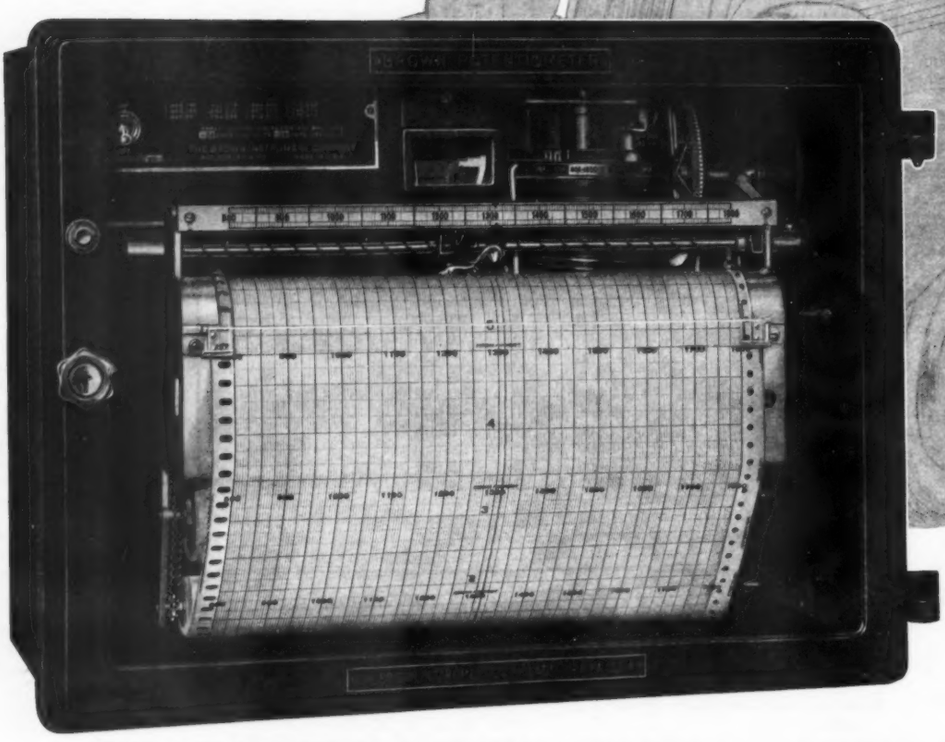
Bradford Oil Refining Co., Bradford, Pa.
Pres., J. H. Rose
V. P., F. D. Korner
Sec. and Treas., H. G. Barcroft
Gen. Mgr., John P. Andrews
Gen. Supt., H. C. Salisbury
Tank Car and Station S. M., H. C. Loveless
Ch. Egr., F. J. Steckmeyer
Ch. Chem., Arthur Barrett
Traf. Mgr., D. R. Hennessy
Refinery located at Bradford, Pa.

Bradford Penn Refining Corp., Clarendon, Pa.
Pres., Forest Dorn
V. P., A. D. David
Sec. and Treas., R. J. Brennan
Gen. Mgr., A. D. David
Supt., D. G. Bathurst
Tank Car S. M., E. E. Hawley
Ch. Chem., W. A. Johnston
Traf. Mgr., E. E. Hawley
Refinery located at Clarendon, Pa.

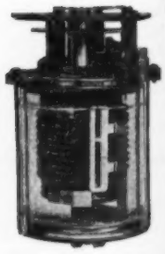
Bradley Refining Co., Kilgore, Tex.
Owner, A. J. Adams
Refinery located at Kilgore, Tex.

Bush, R. R., Oil Co., 2790 Cherry Ave., Long Beach, Calif.
Pres., R. R. Bush
V. P., W. H. Morgan
Sec. and Treas., Neil Enseh

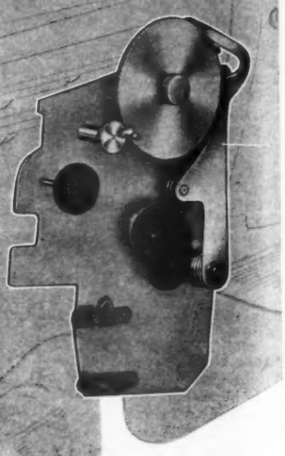
Like a fine Motor Car... Each Unit *is* Assembled *and* Tested



Enclosed Galvanometer



40" Slide Wire



Drive Mechanism

Synchronous Motor

for DEPENDABLE SERVICE

Heavier, stronger working parts give Brown Potentiometer Pyrometers that built-in endurance required for industrial service today or tomorrow. For Indicating, Recording and Controlling temperatures—you can rely on their precision—be confident of their dependability. Unit construction assures Ruggedness and Low Maintenance. For example:

THE GALVANOMETER . . .

Sensitivity and accuracy are combined in the Brown Galvanometer. The pointer is spring-mounted—eliminating coil rocking and strain on the suspensions when the pointer is clamped. There are no delicate micrometric adjustments. The entire unit is completely enclosed, protecting it against errors caused by dust, dirt and air currents; thus, its inherent accuracy and sensitivity is maintained.

THE SLIDE WIRE . . .

Over 40" long, dual wound with extra large wire, has more convolutions than any other industrial Pyrometer. This assures greater accuracy and uniform sensitivity over the entire range and the elimination of errors caused by wear. Totally enclosed, it is fully protected against dust, dirt, fumes and corrosion. Maintenance is negligible.

THE DRIVE MECHANISM . . .

A rugged double ratchet drive is positive in operation and requires no adjustments for wear. It converts and amplifies the galvanometer deflections into powerful movements instantaneously. By means of a gear driven, stainless steel spiral shaft, pen movements are controlled within 1/10% of full scale. All moving parts are permanently timed and equipped with extra large bearings.

THE POWERFUL MOTOR . . .

An oversize synchronous motor with ample reserve power drives the entire mechanism at constant speed. Maintenance is reduced to a minimum as there are no brushes or commutators and the built-in gear reduction unit requires greasing but once a year.

Other outstanding features are fully explained in Catalog No. 1101 . . . Write for it

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C

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Owner, T. E. Patten
Refinery located at Gladewater, Tex.

Calcul Refining Co., Gladewater, Tex.
Owner, L. B. Culberson
Refinery located at Gladewater, Tex.

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Sec. and Treas., R. S. Watt
Supt., C. A. Harris
Ch. Chem., M. B. Jester
Traf. Mgr., John Hayden
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Refinery located at Taft, Calif.

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Station S. M., F. R. Sheller
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Ch. Chem., S. J. Garrett
Pur. Agt., Clifford Hancock
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Pur. Agt. and Traf. Mgr., R. E. Bryant
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Ch. Chem., Charles E. Howk
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Refinery located at Carnegie, Pa.

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Sole owner, Terry Carpenter
Ch. Egr., Joe Jinks
Ch. Chem., Mr. Wilson
Refinery located at Scottsbluff, Nebr.

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Sole owner, M. D. Carson
Ch. Egr. and Chem., J. M. Carson
Refinery located at Brady, Tex.

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Asst. Supt., J. C. Senter, Chalmette, La.
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Pur. Agt., V. G. McPherson
Traf. Mgr., J. E. Loper
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Traf. Mgr., J. L. Morgan
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Sec. and Treas., L. B. Haberle
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Ch. Chem., J. R. Hurmans
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Tank Car S. M., J. A. Kelley
Station S. M., T. J. Spellman
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Ch. Chem., A. H. Alden, East Braintree, Mass.
Pur. Agt., C. L. Boyle
Traf. Mgr., W. A. Hamel
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Owner, L. S. Cole
Refinery located at Oklahoma City, Okla.

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V. P., E. N. Wrightington
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Pur. Agt., Geo. Clark
Traf. Mgr., J. H. Gies
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V. P.s, Owen F. McGee, James Farrel
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Refinery located at Kilgore, Tex.

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Tank Car S. M., K. M. Lyons
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Refinery located at Warren, Pa.

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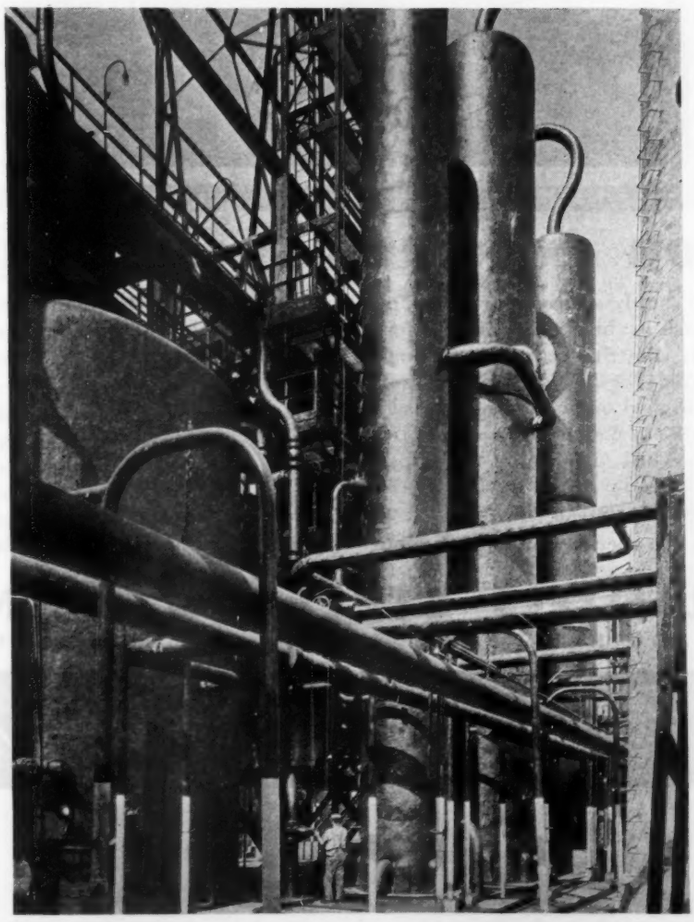
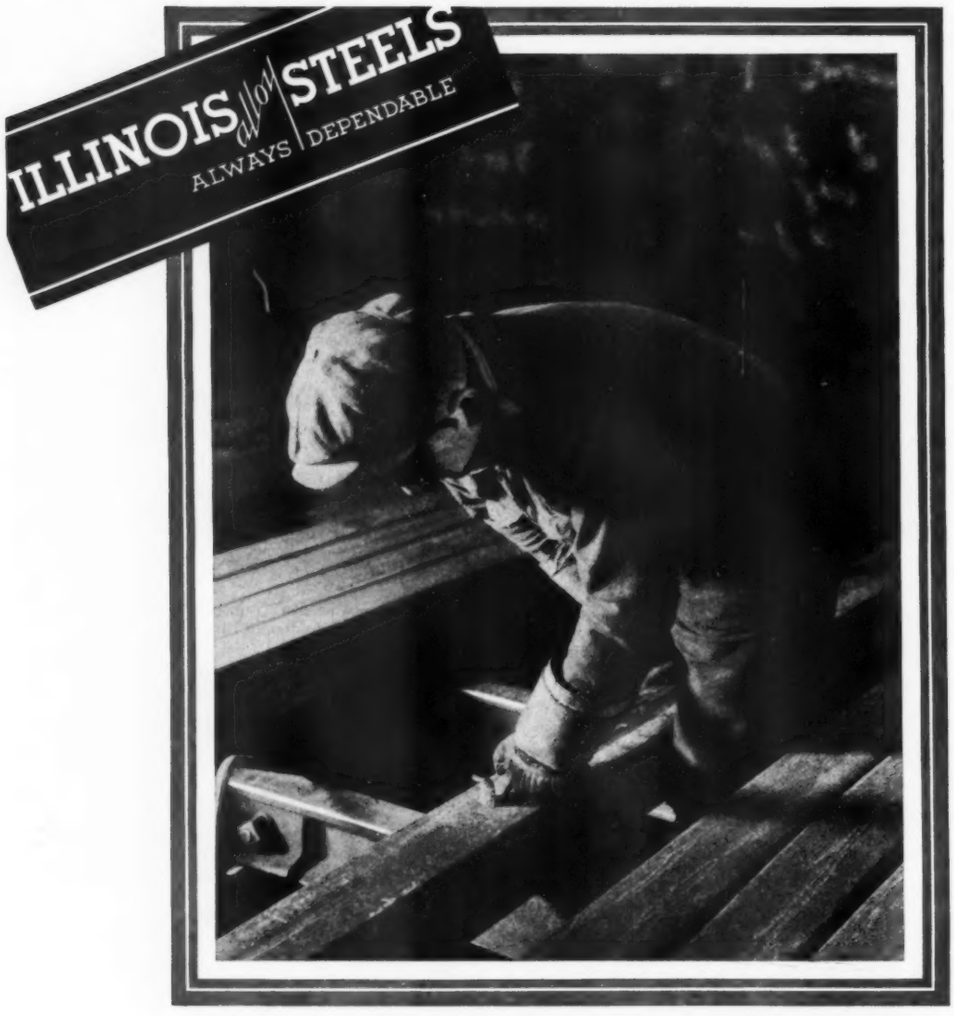
V. P., Thos. Kehoe
Sec. and Treas., W. J. Pfiffner
Supt., A. N. Munhall
Refinery located at Conroe, Tex.

Consolidated Refining Co., Gladewater, Tex.
Owner, George L. Culver
Refinery located at Gladewater, Tex.

Texas Company Installation at Port Arthur, Texas, Refinery



Fractionating towers as part of the vacuum paraffin distillate rerun unit



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Mfg. Mgr., Walter Miller
Asst. Mfg. Mgr., Harold K. Osborn
Supts., Fred G. Fellows, Ponca City, Okla.; J. W. Brown, Baltimore, Md.; D. H. Hyler, Wichita Falls, Tex.; George Smee, Florence, Colo.; C. R. Tillman, Glenrock, Wyo.; C. V. Coulson, Farmington, N. Mex.; Charles Morgan, Artesia, N. Mex.; J. E. Fenex, Denver, Colo.; H. H. Kinnaird, Albuquerque, N. Mex.; L. L. Smith, Lewiston, Mont.
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Ch. Chem., B. H. Lincoln
Pur. Agt., W. H. O'Connor
Traf. Mgr., P. H. Kuhns
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Tank Car and Sta. S. M., C. F. Felton
Ch. Chem., E. F. Hanna
Pur. Agt., H. Wiley
Traf. Mgr., D. C. Hasson
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Asst. Sec., W. D. Richardson
Asst. Treas., A. G. Reed
Gen. Mgr., J. S. Cosden
Supt., J. W. Coast, Big Spring, Tex.
Asst. Supt., E. Potter
Tank Car and Station S. M., W. D. Richardson
Ch. Egr., W. J. Darby
Ch. Chem., J. L. Biles
Station S. M., B. G. Corsgreen, 8 S. Michigan Ave., Chicago.
Pur. Agt., E. E. Brogden
Traf. Mgr., Walker Wilson
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V. P.s, Chas. E. Foster, George W. Hawkins
Sec., A. R. Thorson
Treas., Walter W. Martin
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Asst. Supts., A. P. Frame, Petty Island, N. J.; A. F. Anderson, Titusville, Pa.
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Tank Car S. M., H. C. Gibson
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Mgr. Retail Sales Dept., C. R. Johnson
Ch. Lub. Egr., G. B. Staples
Ch. Chem., E. F. Burch, Petty Island, N. J.
Control Lab., W. N. Westcott
Pur. Agt., E. D. Erney
Traf. Mgr., H. P. Ross
Oper. Dept. Mgr., E. C. Mackey
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Sec., L. L. Dent
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Supts, Geo. Hovell, Smackover, Ark.; J. L. McAndrew, Dupo, Ill.; W. W. Smedley, Joliet, Ill.
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V. P., H. S. Lane
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Traf. Mgr., F. C. Clark
Ch. Chem., H. J. Sheard
Pur. Agt., Paul Smith
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Crystal Oil Works, Oil City, Pa.

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Gen. Supt., W. B. Graham
Refinery located at Rouseville, Pa.

Crystal Refining Co., Kilgore, Tex.

Owner, Frank Reardon
Refinery located at Kilgore, Tex.

Culver Refining Co., Gladewater, Tex.

Owner, George L. Culver
Refinery located at Gladewater, Tex.

Cushing Refining & Gasoline Co., Cushing, Okla.

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V. P., Rex H. Winget
Sec., M. E. James
Treas., R. C. Jones
Gen. Mgr., Rex H. Winget
Gen. Supt., J. H. Hutchinson
Supts., F. A. Davis, Cushing, Okla.; F. C. Hutchinson, Blackwell, Okla.
Cracking Supt., H. A. Booker
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Traf. Mgr., M. E. James
Tank Car S. M., E. O. Derrick
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Gen. Mgr., K. H. Davis
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Gen. Supt., Wayne C. Hart

D

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Treas. and Gen. Mgr., Max Pick
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Refineries located at Petrolia, Pa., and Franklin Creek, Pa.

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Mgr. Refs., W. E. Moody
Supt., Geo. Waltershausen, Cushing, Okla.
Tank Car and Station S. M., W. J. Carthaus, Chicago
Ch. Egr., R. G. Davis, Cushing, Okla.
Ch. Chem., B. Frichot, Cushing, Okla.
Pur. Agt., R. G. Martin
Traf. Mgr., B. J. Burchett, Chicago
Refinery located at Cushing, Okla.

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V. P., E. L. Neville
Sec. and Treas., E. L. Neville
Gen. Mgr., J. W. Painter
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Gen. Supt., F. W. McCurry
Supt., C. R. Black
Tank Car S. M., C. A. Keller
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Ch. Chem., Geo. N. Weber
Pur. Agt., R. E. Cowen
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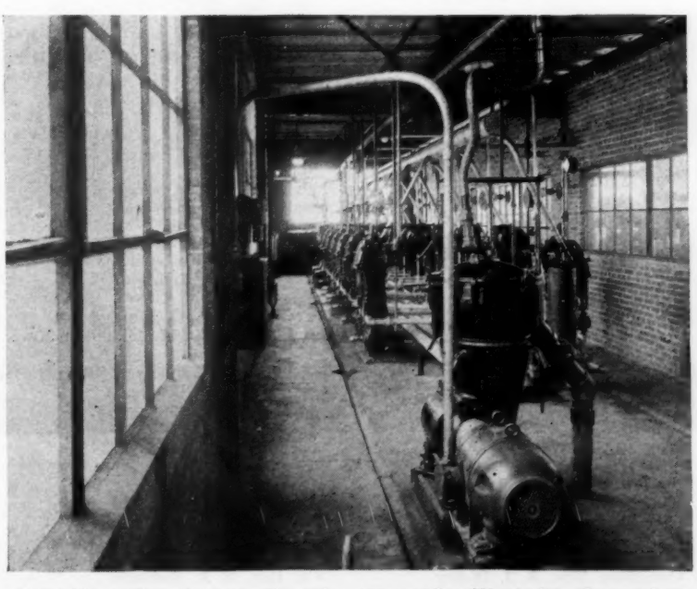

Centrifuges for the separation of extract and raffinate in solvent plant

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Gen. Supt., C. M. Flickenger
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Pur. Agt., C. M. Flickenger
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Gen. Mgr., A. M. Ballard
Gen. Supt., E. L. Rogers
Tank Car and Station S. M., A. M. Ballard
Ch. Chem., Lynn Graves
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Sec. and Treas., H. Grady Graham
Gen. Mgr., E. H. Condon
Gen. Supt., W. F. Mitchell
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Dunlap Refinery, Cat Creek, Mont.

Sole owner, W. F. Dunlap
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E

Eagle Oil & Refining Co., 3328 Elm Ave., Long Beach, Calif.

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V. P., L. D., Hinman
Sec. and Treas., T. W. Eason
Gen. Mgr., T. T. Eason
Supt., P. G. Maranville
Tank Car S. M., R. H. Rowland
Station S. M., J. D. Montgomery
Ch. Egr., W. H. Taft
Ch. Chem., G. B. Lyon
Pur. Agt., A. C. Hatton
Traf. Mgr., E. B. Sinclair
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V. P., John J. Thomas
Sec., R. E. Bishop
Treas., E. V. Campbell
Gen. Mgr., John J. Thomas
Tank Car S. M., Ralph E. Bishop
Station S. M., H. C. Goettig
Ch. Chem., L. C. Atchison
Pur. Agt., W. M. Bisett
Traf. Mgr., A. L. Heine
Refineries located at Longview, Tex.

Eclipse Oil & Refining Co., Inc., Newcastle, Wyo.

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V. P., A. R. Hole
Sec. and Treas., Lewis Arney
Gen. Mgr. and Pur. Agt., B. V. Hole, Jr.
Gen. Supt., Lenard Shell
Refinery located at Newcastle, Wyo.

Edington Oil & Refining Co., Ltd., 2800 Cherry Ave., Long Beach, Calif.

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Sec., A. C. Edington
Treas., C. B. Edington
Gen. Supt., L. A. Foulger
Station S. M., J. D. Brown.
Refinery located at Long Beach, Calif.

Egasco Operating Co., Box 428, Osage, Wyo.

Pres., Albert E. May
V. P., E. E. Wakeman
Sec. and Asst. Treas., A. F. Lesley
Treas., Harry A. May
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V. P., Robert H. Hazlett
Sec., T. A. Helling
Treas., Robert H. Bradford

Gen. Mgr., T. A. Helling
Supt., G. C. Anderson
Asst. Supt., H. J. Datin
Tank Car S. M., C. W. Rice
Station S. M., C. A. Elmborg
Ch. Chem., C. M. Boone
Pur. Agt., O. G. Jackson
Traf. Mgr., R. E. Fisher
Refinery located at Eldorado, Kans.

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V. P. and Treas., F. G. Bannerot, Sr.
Sec., F. G. Bannerot, Jr.
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Supt., Robert Burr, Falling Rock, W. Va.
Asst. Supt., C. J. Hesch, Falling Rock
Tank Car S. M., C. V. Harner
Station S. M., John W. Wright
Ch. Chem., F. A. Nicholson
Pur. Agt., E. B. Hamilton
Traf. Mgr., L. K. Forthman
Refinery located at Falling Rock, W. Va.

Elm Oil Co., Ltd., 3328 Elm Ave., Long Beach, Calif.
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Sec., G. Kindseth
Refinery located at Long Beach, Calif.

Empire Oil & Refining Co., Bartlesville, Okla. (Subsidiary of Cities Service Co.)
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Treas., R. L. Morton, Jr.
Gen. Mgr., P. M. Miskell
Gen. Supt., H. W. Camp
Supts., Edward H. Roy, East Chicago, Ind.; Curtis O. Bailey, Gainesville, Tex.; Don V. Eells, Okmulgee, Okla.; Lee Haugen, Ponca City, Okla.
Tank Car S. M., O. J. Tuttle
Station S. M., W. H. Merritt
Ch. Egr., Clay Briggs
Ch. Chem., W. W. Schuman
Pur. Agt., G. A. Thompson
Traf. Mgr., A. C. Holmes
Refineries located at East Chicago, Ind.; Gainesville, Tex.; Okmulgee, Okla.; Ponca City, Okla.; Cushing, Okla.

Envoy Petroleum Co., 300 Walnut St., Long Beach, Calif.
Pres., A. M. Lockhart
V. P., Harry J. Witz
Sec., Wm. S. Wilsey
Treas., A. M. Lockhart
Gen. Supt., Wm. F. Emory
Asst. Supt., W. A. Shaeffer
Tank Car and Station S. M., A. M. Lockhart
Ch. Chem., W. A. Shaeffer
Pur. Agt. and Traf. Mgr., W. S. Wilsey
Refinery located at Long Beach, Calif.

Estado Petroleum Corp., Ltd., 1315 East Hill St., Long Beach, Calif.
Pres., L. Y. Mattes
V. P., E. E. Greiner
Sec. and Treas., H. Hartsock
Gen. Mgr., L. Y. Mattes
Gen. Supt., E. E. Greiner
Asst. Supt., T. G. Stickels
Ch. Chem., S. A. Blocker
Refinery located at Long Beach, Calif.

Exchange Petroleum Corp., P. O. Box 817, Albany, Tex.
Pres., A. A. Spencer
V. P., H. E. Roberts
Sec. and Treas., H. A. Spencer
Gen. Mgr., A. A. Spencer
Supt., C. C. White
Tank Car S. M., A. A. Spencer
Station S. M., W. A. Waters
Pur. Agt., H. E. Roberts
Refinery located at Albany, Tex.

Exeter Refining Co., 5843 Paramount Blvd., Long Beach, Calif.
Pres., Carl von Bibra
V. P., W. R. Cowan
Sec. and Treas., E. F. Demond
Ref. Mgr., N. F. Gallucci
Sales Mgr., Herb Hershman
Ch. Chem., John Klein
Refinery located at North Long Beach, Calif.

F

Falcon Refining Co., P. O. Box 773, Great Bend, Kans.
Pres., Roy Miller
Sec., R. W. Morris
Treas., H. A. Dickson
Gen. Mgr., H. A. Dickson
Gen. Supt., Roy Miller
Supt., F. O. Case
Tank Car S. M., R. W. Morris
Station S. M., H. A. Dickson
Ch. Chem., John Grubb
Pur. Agt., O. H. Shaffer
Traf. Mgr., R. W. Morris
Refinery located at Great Bend, Kans.

Falls Refining Co., Wichita Falls, Tex.
Pres., James E. Parker
V. P., H. T. Parker
Refinery located at Wichita Falls, Tex.

Fern Oil Co., Thermopolis, Wyo.
Pres., Bruce Sullivan
Sec., Richard Downing
Treas., Russell Murray
Gen. Mgr., Bruce Sullivan
Gen. Supt., D. D. Gibson
Asst. Supt., V. Domenico
Tank Car S. M., Glenn Sullivan
Station S. M., J. W. Johnson
Ch. Chem., J. E. Simon
Pur. Agt., L. A. White
Traf. Mgr., M. M. Carnes
Refinery located at Thermopolis, Wyo.

Franklin Creek Refining Corp., 88 Lexington Ave., New York City
Pres., Dr. Ferdinand Sonneborn
V. P.s, J. F. Roten, S. B. Sonneborn
Sec., R. G. Sonneborn
Treas., Max Pick
Gen. Mgr., C. H. Alsberg
Supt., C. H. Goss
Asst. Supt., D. S. Bleakley
Tank Car S. M., C. H. Alsberg
Ch. Chem., T. G. Murphy
Pur. Agt., C. H. Alsberg
Traf. Mgr., G. H. Kingsley
Refinery located at Franklin, Pa.

Franklin, Wirt, Petroleum Corp., Box 966, Ardmore, Okla.
Pres., Wirt Franklin
V. P., F. M. Porter
V. P. and Treas., Edward Galt
Sec. and Gen. Mgr., F. M. Porter
Station S. M., J. S. Entriken
Tank Car S. M. and Pur. Agt., C. A. Franklin
Ch. Chem., Charles Kemble
Traf. Mgr., Roy Wade
Refinery located at Ardmore, Okla.

Freedom Oil Works Co., Freedom, Pa.
Pres., Earle M. Craig
V. P., Albert B. Craig
Sec. and Treas., C. E. McKee
Supt., B. L. Heath
Refinery S. M., R. B. McKee
Station S. M., E. N. McDonald
Ch. Chem., A. M. Crittenden
Pur. Agt., George J. Mohr
Traf. Mgr., E. W. Niehaus
Refinery located at Freedom, Pa.

Friars Topping Co., Friars Switch, Tex.
Owner, Pat Frailly
Refinery located at Friars Switch, Tex.

G

General Petroleum Corp. of California, 108 W. Second St., Los Angeles, Calif. (Subsidiary of Socony-Vacuum Corp.)
Pres., A. L. Weil
V. P.s, S. J. Dickey, R. A. Sperry, W. L. McLane, A. H. DeFriest
Sec., D. W. Woods
Treas., W. Cunningham
Supts., Fred Isaacs, Vernon; R. C. Wheeler, Lebec.
Consulting Egr., S. J. Dickey
Ch. Chem., G. F. Olsen
Pur. Agt., R. M. Ketchum
Supt. Pipe Lines, E. L. Adams
Traf. Mgr., C. E. Zeigler
Refineries located at Vernon, Torrance, Lebec (all of California)

Gillette Refining Co., Sheridan, Wyo.
Pres., Charles Brittan
V. P., C. R. Carlsen
Sec. and Treas., W. F. O'Brien
Gen. Mgr., V. C. Langford
Gen. Supt., V. C. Langford
Supts., R. V. Copsey, Newcastle, Wyo.; W. F. O'Brien, Gillette, Wyo.; V. C. Langford, Sheridan, Wyo.
Asst. Supt., Geo. Culver, Newcastle, Wyo.; Ray Wright, Gillette, Wyo.; R. M. Kelley, Sheridan, Wyo.
Tank Car and Station S. M., Charles Brittan
Ch. Egr., V. C. Langford
Ch. Chem., R. M. Kelley
Pur. Agt., C. R. Carlsen
Refineries located at Newcastle, Wyo.; Gillette, Wyo., and Sheridan, Wyo.

Gilliland Refining Co., Gladewater, Tex.
Pres., J. W. Gilliland
Sec. and Treas., Albert S. Reagan

Gilmer Oil Co., Gladewater, Tex.
Owners, S. A. Goodson and O. F. Tearil

Gilmore Oil Co., 2423 East Twenty-eighth St., Los Angeles, Calif.
Pres., E. B. Gilmore
V. P. and Treas., C. S. Beesemyer
V. P. and Sec., S. M. Salisbury
Gen. Supt., H. L. Eggleston
Asst. Supts., Perry Vandervort, Roadamite, Calif.; H. E. Marsh, Vernon, Calif.
Ch. Chem., R. H. Pierson
Ser. Sta. S. M., B. A. Rowell
Pur. Agt., L. K. Snyder
Traf. Mgr., J. O. Pfeifer
Refineries located at Vernon and Roadamite, Calif.

Glasgow Oil & Refining Co., Glasgow, Ky.
Pres., R. B. Tyler
Sec. and Treas., Sewell C. Harlin
Station S. M., J. R. Richey
Refinery located at Glasgow, Ky.

Globe Oil & Refining Co. (Ill.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec. and Treas., G. G. Woodruff
Asst. Sec. and Treas., R. E. Everitt
Gen. Mgr., F. L. Jehle
Supt., H. B. Overton, Lemont, Ill.
Asst. Supt., G. R. Russell, Lemont, Ill.
Tank Car S. M., A. E. Landsittel
Asst. S. M., B. L. Meece
Ch. Egr., G. R. Russell
Ch. Chem., C. C. Twichell
Pur. Agt., H. B. Overton
Refinery located at Lemont, Ill.

Globe Oil & Refining Co. (Kans.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec. and Treas., J. F. O'Shaughnessy
Asst. Sec. and Treas., R. E. Everitt
Gen. Mgr., F. L. Jehle
Plant Mgr., E. J. Mary
Supt., J. K. Mackinnon, McPherson, Kans.
Tank Car S. M., A. E. Landsittel
Asst. S. M., Geo. C. Jehle
Ch. Chem., N. K. Hopp
Pur. Agt., E. J. Mary
Traf. Mgr., R. E. Walcher
Refinery located at McPherson, Kans.

Globe Oil & Refining Co. (Okla.), Box 820, Blackwell, Okla.
Pres., I. A. O'Shaughnessy
V. P., F. L. Jehle
Sec., R. E. Everitt
Treas., E. A. Lentz
Gen. Mgr., F. L. Jehle
Supt., O. D. Gurley
Asst. Supt., R. D. McCrum
Tank Car S. M., A. E. Landsittel
Asst. Sales Mgr., Geo. C. Jehle
Ch. Egr., S. P. Redfearn
Ch. Chem., A. A. Gilbert
Traf. Mgr., E. R. Walcher
Pur. Agt., L. S. Coombs
Refinery located at Blackwell, Okla.

Golden Rule Refining Co., Wichita, Kans.
Pres., Elbert S. Rule
Sec. and Treas., W. C. Long
Gen. Mgr., Elbert S. Rule
Supt., J. E. McIntire
Tank Car and Station S. M., W. C. Long
Ch. Chem., O. B. Vanfossen
Pur. Agt., W. C. Long
Refinery located at Wichita, Kans.

Goldman Refining Co., Gladewater, Tex.
Owner, Harry Goldman
Refinery located at Gladewater, Tex.

Goodson Bros. Refining Co., Gladewater, Tex.
Owners, S. A. Goodson and Lee Goodson
Refinery located at Gladewater, Tex.

Goshen Oil Refining Co., Torrington, Wyo.
Pres., M. A. Eaton
V. P., S. J. Eaton
Sec. and Treas., Irene Eaton
Gen. Supt., E. D. Bishop
Refinery located at Torrington, Wyo.

Government Refining Co., 2109 First National Bldg., Oklahoma City, Okla.
Pres., Robert A. Wallace
Sec., K. B. Harton
Refineries located at Oklahoma City and Seminole

Gratex Refining & Fuel Oil Co., P. O. Box 307, Graham, Tex.
Pres., G. O. Cozart
Supt., W. O. Cozart
Refinery located at Graham, Tex.

Greenville Refining Co., Inc., Greenville, Ky.
Pres., W. C. Malone
V. P., H. E. Eaves, Sr.
Sec. and Treas., H. E. Eaves, Jr.
Gen. Mgr., B. L. Andrews
Sales Mgr., H. E. Eaves, Jr.
Pur. Agt., H. E. Eaves, Jr.
Refinery located at Greenville (Muhlenberg County), Ky.

Gregg Oil Products, Gladewater, Tex.
Owner, Joe Zucarro
Refinery located at Gladewater, Tex.

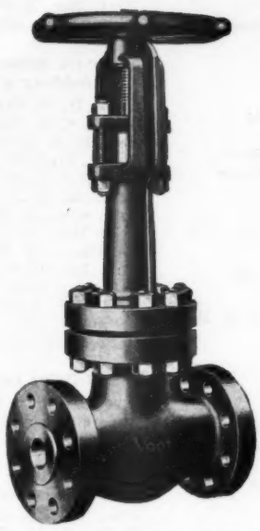
Griswold Refining Co., Box 1364, Shreveport, La.
Owner, E. F. Griswold
Gen. Supt. Ref., C. L. Higenfeldt
Refinery located at Shreveport, La.

Gulf Refining Co., Gulf Bldg., Pittsburgh, Pa.
Pres., J. F. Drake
V. P.s, Chas. B. Buerger, W. V. Hartmann, J. R. Williams, H. A. Gidney
Sec., W. J. Guthrie
Treas., J. E. Nelson
Gen. Mgr., Wm. A. Slater
Mgr. Refineries, H. V. Sanderson, Staten Island, N. Y.
Supts., T. J. Sullivan, Port Arthur, Tex.; Herman Taylor, Fort Worth, Tex.; T. F. Hogan, Sweetwater, Tex.; W. M. Crockett, Philadelphia, Pa.; W. M. Braybrooks, Staten Island, N. Y.; M. J. Ball, Pittsburgh, Pa.; B. H. Barnes, Toledo, Ohio; T. J. Twomey, Cincinnati, Ohio
Asst. Supts., G. I. Roberts, Port Arthur, Tex.; J. E. Biggins, Philadelphia, Pa.; J. H. Wackenhut, Pittsburgh, Pa.; R. C. Faulkner, Toledo, Ohio; John W. Schriever, Cincinnati, Ohio
Mgr. Construction Div., Herbert Henderson
Mgr. Refinery Technology, H. G. Smith
Pur. Agt., C. T. Marsh
Traf. Mgr., C. B. Ellis
Refineries located at Port Arthur, Tex.; Fort Worth, Tex.; Sweetwater, Tex.; Philadelphia, Pa.; Staten Island, N. Y.; Pittsburgh, Pa.; Toledo, Ohio, and Cincinnati, Ohio

Vogt

SINCE 1880

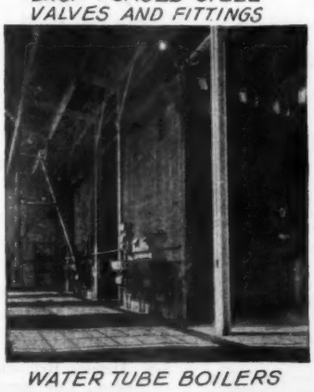
REFINERY EQUIPMENT



DROP FORGED STEEL VALVES AND FITTINGS

Yesterday

Our steady growth since 1880 has resulted logically from forethought in anticipating demands for improved refinery equipment as the Industry moved forward.



WATER TUBE BOILERS

Today

With a background of experience covering more than half a century, our engineers are in position to design equipment which will secure results required of present petroleum refining processes.

Tomorrow

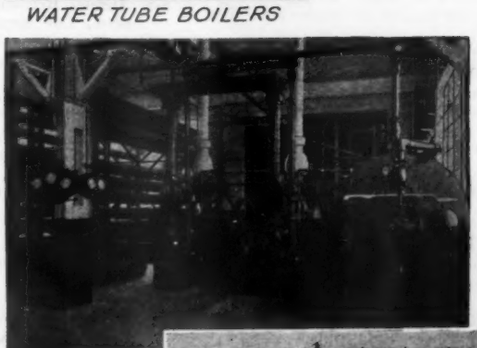
The engineering, research and manufacturing facilities of this Company are such as will adequately meet the future demands of the Petroleum Industry.

HENRY VOGT MACHINE CO.

INCORPORATED

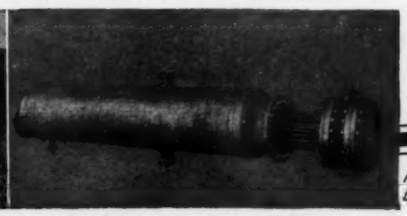
LOUISVILLE KENTUCKY

NEW YORK • PHILADELPHIA • CHICAGO • DALLAS
CLEVELAND • CINCINNATI • KANSAS CITY



ABSORPTION AND COMPRESSION REFRIGERATING SYSTEMS

REFINERY STILLS AND TOWERS



HEAT EXCHANGERS

H

Hancock Oil Co. of California, 2828 Junipero St., Long Beach, Calif.
Pres., W. J. Reid
V. P., Geo. D. Williams
Sec., Geo. D. Williams
Treas., G. P. Deane
Gen. Mgr., W. J. Reid
Gen. Supt., Geo. D. Williams
Supt., H. D. Tupper
Asst. Supt., W. T. Hancock
Tank Car S. M., C. B. Limbocker
Station S. M., C. B. Limbocker
Ch. Chem., LaVerne Smith
Pur. Agt., W. Westegard
Refinery located at Long Beach, Calif.

Hausman, Louis, Oil Co., North Laredo, Tex.
Sole Owner, Louis Hausman
Ch. Chem., Marion Beaver
Refinery located at North Laredo, Tex.

Hill Refining Co., Ballinger, Tex.
Sole Owner, Roy L. Hill
Gen. Supt., G. T. Beddo
Sales Mgr., G. T. Beddo
Pur. Agt., G. T. Beddo
Ch. Egr., C. G. Cape
Refinery located at Ballinger, Tex.

Home Oil & Refining Co., Great Falls, Mont.
Pres., W. E. Rice
V. P., John S. Rice
Sec. and Treas., Fred Erickson
Gen. Mgr., H. O. Batzer
Gen. Supt., Joe Faulkner
Sales Mgr., H. O. Batzer
Ch. Chem., Boyd Morris
Pur. Agt., H. O. Batzer
Refinery located at Great Falls, Mont.

Houston Oil Co. of Texas, Petroleum Bldg., Houston, Tex.
Pres., Geo. A. Hill, Jr.
V. P. and Treas., L. S. Zimmerman, Baltimore, Md.
Sec., A. H. Kennerly
Gen. Mgr., R. R. Hobson
Gen. Supt., F. Y. Hutchinson
Supt., G. H. Hartung, Camden, Ark.
Tank Car and Sta. S. M., J. B. Benson
Ch. Egr., F. Y. Hutchinson
Ch. Chem., R. H. Cook
Pur. Agt., O. S. Cummings, Jr.
Traf. Mgr., P. W. Schumacher
Refineries located at Camden, Ark., and Viola, Tex. Camden plant shut down.

Howard County Refining Co., Big Spring, Tex.
Pres., Robert T. Piner
Sec., Joseph Edwards
Gen. Mgr. and Pur. Agt., Joseph Edwards
Supt., F. C. Davenport
Tank Car and Station S. M., Henry Edwards
Refinery located at Big Spring, Tex.

Hub Refining Co., Reeds Switch, Tex.
Owner, R. H. Foss
Refinery located at Reeds Switch, Tex.

Huckins Refinery, Earlsboro, Okla.
Sole Owner, J. C. Huckins
Refinery located at Earlsboro, Okla.

Humble Oil & Refining Co., Humble Bldg., Houston, Tex. (Subsidiary of Standard Oil Co. of New Jersey)
Pres., R. L. Blaffer
V. P.s, H. C. Weiss, Wallace E. Pratt, John R. Suman, Judge E. E. Townes, James Anderson
Sec., F. O. Freese
Treas., R. L. Blaffer
Gen. Counsel, Judge E. E. Townes
Gen. Mgr. of Ref., J. L. Finley
Ref. Mgr., R. E. Powell, Baytown
Supts., F. N. Read, Ingleside; G. L. Farned, Baytown; C. M. Bell, San Antonio; C. M. Dennison, Neches.
Asst. Supts., C. E. Carlson, M. L. Snyder, Baytown; G. P. Curtin, Ingleside
Tank Car S. M., B. H. Brown
Station S. M., S. A. Giraud
Ch. Egr. Ref., Dr. E. F. Voss
Ch. Egr. Prod., W. W. Scott
Ch. Chem., Dr. H. D. Wilde, Jr.
Pur. Agt., J. M. Sitler
Traf. Mgr., J. R. Davis
Refineries located at Baytown, Ingleside, San Antonio and Neches

I

Ideal Refining Co., Gladewater, Tex.
Owners, J. L. Quinn and A. L. Weiss
Refinery located at Gladewater, Tex.

Illinois Oil Co., Rock Island, Ill.
Pres., Frank P. Welch
V. P., J. W. Armstrong
Sec. and Treas., F. R. Edwards
Gen. Mgr., Frank P. Welch
Gen. Supt., P. J. Glover, Cushing, Okla.
Asst. Supt., W. W. Kelly, Cushing
Tank Car and Station S. M., F. R. Edwards
Pur. Agt., F. R. Edwards
Traf. Mgr., P. J. Glover
Refinery located at Cushing, Okla.

Illinois Refining Co., Kilgore, Tex.
Owner, Roger Lacey
Refinery located at Kilgore, Tex.

Independent Refining Co., Fratt Bldg., Billings, Mont.
Pres., W. E. Rice, Great Falls, Mont.
V. P. and Gen. Mgr., D. E. Hageman
Sec., H. J. Coleman
Treas., D. E. Hageman
Supt., W. D. Manz
Sales Mgr., D. E. Hageman
Ch. Chem., J. M. Williams
Pur. Agt. and Traf. Mgr., P. A. Thomson
Refinery located at Laurel, Mont.

Indian Refining Co., 1 Havoline St., Lawrenceville, Ill. (Subsidiary of the Texas Corp.)
Pres., W. S. S. Rodgers
V. P.s, P. C. Scullin, F. T. Manley, S. B. Wright, H. W. Dodge
Sec., E. M. Crone
Treas., C. E. Woodbridge
Gen. Mgr., P. C. Scullin
Supt., G. R. Bryant
Asst. Supt., W. B. Logan
Tank Car and Station S. M., T. C. Twyman, 5 East Market St., Circle Tower Bldg., Indianapolis, Ind.
Pur. Agt., A. F. Colling, 135 East Forty-second St., New York City
Refinery located at Lawrence, Ill.

J

Jackson Refining Co., Gladewater, Tex.
Owners, J. E. Connor, F. D. Jackson and C. D. Archer

Jenson Oil Refining Co., 304 Atlas Block, Salt Lake City, Utah
Pres., J. B. Jenson
V. P., Carl Selander
Sec. and Treas., Irma M. Jenson
Gen. Mgr., J. B. Jenson
Gen. Supt., Wm. G. Stenberg
Tank Car and Stations Mgr., R. N. Bostwick
Ch. Egr., Ira Packard
Refinery located at Ogden, Utah.

Johnson, A. L., Refinery, Wayne, Ohio
Sole Owner, A. L. Johnson
Refinery located at Wayne, Ohio

Johnson Oil Refining Co., 176 West Adams St., Chicago, Ill.
Pres., I. H. Johnson
V. P., L. Ralph Johnson, Cleveland, Okla.
Ch. Board, J. J. Johnson
Sec., G. C. Lilly
Treas., J. O. Horton
Gen. Mgr., I. H. Johnson
Gen. Supt., L. Ralph Johnson, Cleveland, Okla.
Supt., W. J. Leenhouts, Cleveland, Okla.
Tank Car S. M., H. G. Plane
Bulk S. M., James J. Johnson
Ch. Egr., Frank P. Frey
Pur. Agt., V. C. Goward, Cleveland, Okla.
Traf. Mgr., G. A. Mindeman, Cleveland, Okla.
Refinery located at Cleveland, Okla.

Johnson Refining Co., Kilgore, Tex.
Owner, H. I. Johnson
Refinery located at Kilgore, Tex.

Joplin Refining Co., Box 866, Joplin, Mo.
Pres., A. E. Basinger
V. P., W. F. Maher
Gen. Supt., C. S. Banks
Tank Car and Station S. M., George J. Young
Refinery located at Joplin, Mo.

K

Kanotex Refining Co., Arkansas City, Kans.
Pres. and Gen. Mgr., C. M. Boggs
V. P., W. L. Lesh
Sec., Mrs. E. K. Childers
Treas., R. R. Cox
Supt., F. A. Deering
Asst. Supt., Charles Wakefield
Ch. Egr., D. O. Givens
Ch. Chem (plant), Guy S. Kirk
Research Chem., H. L. Lightstone
Pur. Agt., L. E. Watts
Traf. Mgr., C. E. Varner
Refinery located at Arkansas City, Kans.

Kendall Refining Co., Bradford, Pa.
Pres., Otto Koch
V. P.s, H. H. Greene, Joseph H. Bovaird
Sec., J. Bertram Fisher
Treas., Otto Koch
Gen. Mgr., Otto Koch
Ref. Mgr., E. E. Bown
Process Supt., Francis J. Healy
Tank Car S. M., H. H. Greene
Lub. S. M., T. O. Grisell
Sales Mgr., bulk, J. B. Fisher
Plant Egr., S. M. Wolbert
Ch. Chem., Frank Philippbar
Pur. Agt., J. B. Fisher
Traf. Mgr., James White
Refinery located at Bradford, Pa.

Keystone Oil Refining Co., 12800 Northampton Ave., Detroit, Mich.
Pres., Wm. Fisher
V. P., G. Fisher
Sec., Leon Komisaruk
Treas., Wm. Fisher
Supt., Leon Komisaruk
Asst. Supt., Wm. H. Osborn
Tank Car S. M., Maurice Schiller
Ch. Egr., Leon Komisaruk
Ch. Chem., Amos Comay
Pur. Agt., Wm. Fisher
Traf. Mgr., Irving Schiff
Refinery located at Detroit, Mich.

Keystone Refining Co., Gladewater, Tex.
Owner, S. B. Pope
Refinery located at Gladewater, Tex.

Kilgore Topping & Refining Co., Kilgore, Tex.
Owner, J. L. Tolbert
Refinery located at Kilgore, Tex.

Kilgore Refining Co., Kilgore, Tex.
Pres., J. D. Wrather
Treas., John Wrather
Sec., G. C. Walters

Kiltex Refining Co., Kilgore, Tex.
Owner, O. C. Thornton
Refinery located at Kilgore, Tex.

Knox Refining Co., Tenth Floor, Broadway Tower, Enid, Okla.
Sole Owner, Chas. E. Knox
Sales Mgr., Roy E. Raemer

Kolingo Refining Co., Coalinga, Calif.
Refinery located at Coalinga, Calif.

L

Lake Refining Co., Gladewater, Tex.
Management, F. Ferriss, John Kraker, N. Rudman
Refinery located at Gladewater, Tex.

Lake View Oil & Refining Co., 1007 Edwards & Wildey Bldg., Los Angeles, Calif. (Receivership)
Receiver, Paul J. Hisey
V. P., A. J. Rehwold
Sec., Paul J. Hisey
Treas., C. F. Powers
Refinery located at Maricopa, Calif.

La Pren Refining Co., Kilgore, Tex.
Lessee, J. C. White
Refinery located at Kilgore, Tex.

LaSalle Petroleum Co., 612 Wright Bldg., Tulsa, Okla.
Receivers, W. J. Schnur, Tulsa, Okla.; Phil D. Williams, Burkburnett, Tex.
Supt., Phil D. Williams, Burkburnett, Tex.
Sales Mgr., Phil D. Williams
Pur. Agt., Phil D. Williams
Traf. Mgr., J. E. Tanner
Refinery located at Burkburnett, Tex.

Lincoln Oil Refining Co., Robinson, Ill. (Subsidiary of Ohio Oil Co.)
Pres., H. B. Carpenter
V. P.s, C. L. Fleming, R. E. Luton
Sec., E. B. Redpath
Treas., F. A. Billstone
Gen. Mgr., H. B. Carpenter
Supt., R. E. Luton
Asst. Supt., H. E. Handy
Sales Mgr., N. T. Stover
Ch. Chem., T. W. Culwer
Pur. Agt., C. S. Sherk, Ohio Oil Co., Findlay, Ohio
Traf. Mgr., E. W. Evans, Ohio Oil Co., Findlay, Ohio
Refinery located at Robinson, Ill.

Linzie Refining Co., Gladewater, Tex.
Owners, George L. Culver, W. H. McKain and Nathan Culver
Refinery located at Kilgore, Tex.

Lion Oil Refining Co., Exchange Bldg., El Dorado, Ark.
Pres., T. H. Barton
V. P.s, T. M. Martin, M. E. Wilson, J. J. Allinson
Sec., Jeff Davis
Treas., R. E. Meinert
Gen. Mgr., T. H. Barton
Ref. Mgr., J. J. Allinson
Supt., J. B. Rogerson
Tank Car S. M., T. M. Martin
Asst. Tank Car S. M., P. G. Anderson
Station S. M., A. F. Reed
Asst. Station S. M., G. M. Hale
Ch. Chem., W. M. Carney, Jr.
Ch. Egr., J. B. Rogerson
Pur. Agt., R. E. Meinert
Traf. Mgr., P. G. Anderson
Refinery located at El Dorado, Ark.

Lone Star Refining Co., Gladewater, Tex.
Owner, V. C. Jackson
Refinery located at Gladewater, Tex.

Los Angeles Refining Co., 4037 Bandini Blvd., Los Angeles, Calif.
Gen. Mgr., Glenn Dies
Refinery located at Bandini, Calif.

Louisiana Oil Refining Corp., Ardis Bldg., Shreveport, La. (Subsidiary of Cities Service Co.)
Pres., H. L. Doherty
V. P.s, D. W. Harris, W. A. Jones, T. I. Carter, H. D. Frueauff and J. R. Munce
Sec., T. J. Heard
Treas., B. R. Muirhead
Gen. Mgr., D. W. Harris
Gen. Mgr. Ref., R. B. Pierce
Supt., H. R. Smith, Bossier plant
Asst. Supt., G. W. Wilbur, Bossier plant
Tank Car S. M., E. F. Brakefield
Gen. Station S. M., J. A. Welch
Ch. Egr., H. T. Goss
Ch. Chem., A. W. Trusty
Pur. Agt., J. Lucas
Traf. Mgr., E. M. Hinkle
Refineries located at Shreveport, La., and Bossier City, La. (Shreveport plant shut down)

Louisville Refining Co., Inc., 52 U. S. Trust Bldg., Louisville, Ky.
Pres., Eli H. Brown, Jr.
V. P., J. Fred Miles
Sec. and Treas., H. R. Smith
Gen. Mgr., J. Fred Miles
Asst. Supt., J. J. Loudermill
Tank Car S. M., H. R. Smith
Ch. Egr., E. S. Handley

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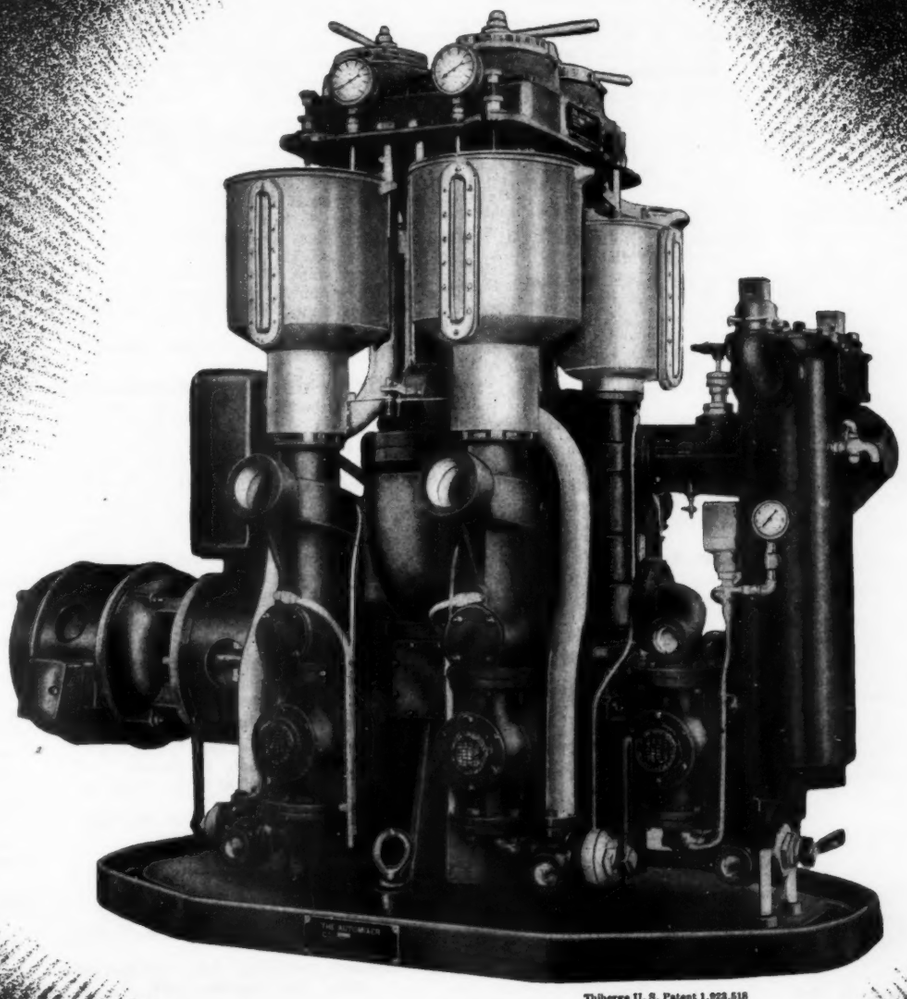

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Pur. Agt., W. A. Waples
Traf. Mgr., H. R. Smith
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Lusk Oil & Refining Co., Lusk, Wyo.
Pres., J. W. Siegfried
V. P., W. Deedjen
Sec. and Treas., Don R. Saylor
Refinery located at Lusk, Wyo.

M

Macmillan Petroleum Corp., 530 West Sixth St., Los Angeles, Calif.
Pres., R. S. Macmillan
V. P.s, H. E. Boner, H. R. Macmillan
Sec. and Treas., Dewitt Knox
Gen. Supt., H. E. Boner
Supts., C. C. Benz, Long Beach; L. L. Rebber, El Dorado, Ark.
Tank Car S. M., Dewitt Knox, Los Angeles; S. M. Batterson, El Dorado, Ark.
Station S. M., W. G. Ebersole, Los Angeles
Ch. Chem., S. E. Campbell
Refineries located at Long Beach, Calif., and El Dorado, Ark.

Magnolia Petroleum Co., Magnolia Bldg., Dallas, Tex.
Pres., D. A. Little
V. P.s, W. H. Francis, E. E. Plumly, M. J. McLaughlin, J. C. Stephens, Ralph H. Kinsloe, Clyde M. Bennett, F. M. Lege, Jr., C. L. Gladden, T. J. Fitch
Sec., L. S. Sinclair
Treas., W. L. Holmes
Gen. Mgr., Ralph H. Kinsloe
Gen. Mgr. Ref., E. E. Plumly
Supts., C. S. Dickens, Beaumont; W. C. White, Magpetco; John Ricker, Fort Worth; W. C. Ralston, Corsicana; J. T. Dickens, Luling
Asst. Supts., G. E. Plumly, Beaumont; Eugene Ritter, Fort Worth; N. B. Marchbanks, Luling
Tank Car S. M., George Miller
Station S. M., F. M. Lege, Jr.
Ch. Egr., R. G. Sanders
Ch. Chem., W. W. Leach
Pur. Agt., J. P. David
Traf. Mgr., W. M. Maddox
Refineries located at Beaumont, Magpetco, Fort Worth, Corsicana and Luling.

Major Petroleum Products Co., 2500 E. Reno, Oklahoma City, Okla.
Pres., C. B. Warr
V. P., J. W. Lyons
Sec. and Treas., E. B. Treadwell
Gen. Mgr., W. U. Paul
Gen. Supt., W. O. Leek
Tank Car and Sta. S. M., E. A. Gilmore
Ch. Chem., Thomas Vaughn
Refinery located at Oklahoma City, Okla.

Malco Refineries, Inc., Artesia, N. Mex.
Pres., M. E. Barsh
V. P., L. R. Simon
Sec. and Treas., R. A. Shugart
Gen. Supt., L. R. Simon
Ch. Egr. and Ch. Chem., L. R. Simon
Tank Car and Station S. M., R. L. Hailey
Refinery located at Artesia, N. Mex.

Mancos Dome Refining Co., Farmington, N. Mex.
Trustee, A. C. Kittrell
Refinery located at Mancos Creek, Colo.

Marathon Oil Co., Thompson Bldg., Tulsa, Okla. (Subsidiary of Ohio Oil Co.)
Pres., W. W. Fleming
V. P.s, J. B. McCammon, M. E. Wagner, J. L. Cook.
Sec., W. J. Willson
Treas., J. L. Cook
Gen. Supt., A. J. Slagter
Supts., J. R. Barrott, Bristow; W. R. Sonricker, Fort Worth
Tank Car S. M., H. L. Jackson
Pur. Agt., W. R. Brown
Traf. Mgr., W. W. Klingensmith
Refineries located at Bristow, Okla., and Fort Worth, Tex.

Maritime Oil Co., lessee of Deepwater Oil Refineries, Houston, Tex.
Pres., L. F. Rothermel
V. P., M. S. Rothermel
Sec. and Treas., J. H. Crawford
Supt., L. M. Harper
Tank Car S. M., John M. M'Guire
Refinery located at Houston, Tex.

Master Petroleum Co., 401 Amicable Bldg., Waco, Tex.
Pres., S. J. T. Smith
V. P., R. V. McClain
Sec. and Treas., Floyd Casey
Gen. Supt., Carl Casey
Tank Car S. M., R. L. Seastrunk
Ch. Chem., Carl Casey
Refinery located at Waco, Tex.

McCallen, M. M., Refining & Producing Co., Seventeenth and Garfield Sts., Huntington Beach, Calif.
Owner, M. M. McCallen
Auditor, J. T. Africa
Gen. Supt., P. L. Davis
Ch. Chem. and Pur. Agt., Roy Seabridge
Refinery located at Huntington Beach, Calif.

McClanahan Refineries, Inc., Mount Pleasant, Mich.
Pres., W. L. McClanahan
V. P., Eshurn Hansen
Sec., Grant L. Cook
Treas., Arnold H. Goss
Gen. Mgr., D. E. Foster
Gen. Supt., M. C. Sumpter
Refinery located at St. Louis, Mich.

McGarr Petroleum Corp., Kline, Colo.
Pres., G. M. McGarr
V. P., A. L. Krueger
Sec., Ruth Z. Brazil
Treas., C. R. Brice
Refinery located at Kline, Colo.

McKain Refining Co., Gladewater, Tex.
Owner, Wm. H. McKain
Refinery located at Gladewater, Tex.

McMurray Refining Co., Arp, Tex.
Owners, Marvin McMurray and R. J. McMurray
Refinery located at Arp, Tex.

McNutt Oil & Refining Co., Inc., P.O. Box 1161, El Paso, Tex.
Pres., C. M. McNutt
V. P., C. E. McNutt
Sec. and Treas., C. Blaine McNutt
Gen. Mgr., C. M. McNutt
Supt., A. C. Sturgis
Asst. Supt., George A. Baker
Tank Car S. M., C. M. McNutt
Station S. M., R. E. Faith
Ch. Egr., A. C. Sturgis
Ch. Chem., C. E. McNutt
Pur. Agt. and Traf. Mgr., H. T. Weiler
Refinery located at Brickland, N. Mex.

McOwen, Howard A., 2240 South St., North Long Beach, Calif.
Refinery located at Long Beach, Calif.

Mentone Oil & Refining Co., Mentone, Tex.
Partners, H. C. Chaddick, E. T. Barker, Jr.
Refinery located at Arno, Tex.

Mid-Continent Petroleum Corp., Cosden Bldg., Tulsa, Okla.
Pres., Jacob France
V. P.s, J. C. Denton, R. W. McDowell, F. B. Koontz, E. M. Rouzer, Geo. Moody
Sec., E. M. Rouzer
Gen. Mgr., Jacob France
Treas., Charles Klein
Gen. Supt., F. B. Koontz
Supt., D. G. Morgan
Ch. Chem., H. T. Bennett
Pur. Agt., C. A. Prichard
Sales Mgr., R. W. McDowell
Traf. Mgr., H. W. Roe
Refinery located at West Tulsa, Okla.

Middlesex Refining Co., 60 East Forty-second St., New York
Pres., Thomas Graham
V. P., Henry A. Siebrecht
Sec., Thomas C. Meadows
Treas., Louis H. Bean
Gen. Supt., W. Lelgemann
Consulting Egr., Geo. Benhoff
Ch. Egr., Geo. Benhoff
Ch. Chem., W. Lelgemann
Refinery located at New Brunswick, N. J.

Midland Oil Refining Co., 311 Midland Savings Bldg., Denver, Colo.
Pres., L. M. Hines
V. P., Mahlon B. Johnson
Sec. and Treas., L. R. Hines
Gen. Mgr., Bruce Sullivan
Gen. Supt., V. C. Langford
Tank Car S. M., W. C. Williams
Ch. Egr., Howard L. Minister
Ch. Chem., C. Fred Russell
Pur. Agt., Cliff L. Messenger
Traf. Mgr., J. Fred Foley
Refinery located at Brighton Road, Denver, Colo.

Midwest Refineries, Inc., 610 Murray Bldg., Grand Rapids, Mich.
Pres., B. J. Skinner
V. P., T. E. McFall
Sec., G. B. Tokeris
Treas., F. S. Grimes
Gen. Mgr., B. J. Skinner
Supt., J. Marshall
Asst. Supt., B. Thurston
Sales Mgr., F. S. Grimes
Pur. Agts., B. J. Skinner and F. S. Grimes
Refinery located at Alma, Mich.

Miller, A. D., Sons Co., 1801 Preble Ave., Pittsburgh, Pa.
Pres., J. B. Miller
V. P., A. D. Miller, III
Sec., O. B. Opsion
Treas., A. D. Miller, III
Gen. Mgr., J. B. Miller
Gen. Supt., O. B. Opsion
Supt., Wm. Clowes
Asst. Supt., Geo. Clowes
Tank Car S. M., O. B. Opsion
Ch. Egr., Wm. Clowes
Ch. Chem., J. B. Miller
Pur. Agt., J. B. Miller
Traf. Mgr., O. B. Opsion
Refinery located at Pittsburgh, Pa.

Minntana Oil Co., 831 Second Ave., S., Minneapolis, Minn.
Pres., Alger R. Syme
Sec. and Treas., R. M. Heskett
Refinery located at Molt, Mont.

Mohawk Petroleum Co., 405 Montgomery St., San Francisco, Calif.
Pres., Alfred L. Marsten
V. P., Edwin V. McKenzie
Sec. and Treas., M. E. Roof
Supt., J. A. Robinson, Bakersfield
Refinery located at Bakersfield, Calif.

Monarch Refineries, Ltd., 820 Detwiler Bldg., Los Angeles, Calif.
Pres., Charles W. Fourl
V. P., W. J. Williams
Sec. and Treas., C. W. Fourl
Gen. Supt., Frank McGee
Station S. M., Homer Ames
Refinery located at Playa Del Rey, Calif.

Motor Fuel Products Corp., Box 2492, Houston, Tex.
Pres., N. C. McGowen
V. P., R. H. Hargrove
Sec., G. D. Fisher
Treasurer, L. V. Tracht
Refinery located at Laredo, Tex.

Moutray Oil Co., 602 Pine St., Abilene, Tex.
Pres., E. W. Moutray
V. P., C. B. Snyder
Sec. and Treas., M. P. Moutray
Gen. Mgr., E. W. Moutray
Gen. Supt., W. W. Moutray
Tank Car S. M., E. W. Moutray
Station S. M., Paul Kirk
Ch. Chem., W. C. Vernon
Refinery located at Hawley, Tex.

Muenster Refining Co., Muenster, Tex.
Owner and Supt., A. G. Hutton
Refinery located at Muenster, Tex.

N

Naph-Sol Refining Co., R.F.D. 3, Muskegon, Mich.
Pres., Walter E. Anderson
V. P., J. F. Helms
Sec. and Treas., A. W. Penny
Gen. Mgr., Walter E. Anderson
Gen. Supt., J. F. Helms
Asst. Supt., Hal B. Burrell
Tank Car S. M., Allen F. Hickey
Ch. Chem., Walter C. Fisher
Pur. Agt., C. S. Walkowiak
Traf. Mgr., J. A. Sundquist
Refinery located at Muskegon, Mich.

National Refining Co., Hanna Bldg., Cleveland, Ohio
Pres., Frank B. Fretter
V.P.s, C. S. Smith, W. H. Lamprecht, II
Sec., J. D. Sadler
Treas, H. F. Heil
Gen. Supt., F. B. Fretter
Traf. Mgr., E. E. Harrington
Refineries located at Coffeyville, Kans.; Findlay, Ohio, and Marietta, Ohio.

Northwestern Petroleum Co., Osage, Wyo.
Gen. Mgr., F. W. Palis
Refinery located at Osage, Wyo.

Norwalk Co., 634 South Spring St., Los Angeles, Calif.
Pres., Lionel T. Barneson
V. P., H. J. Barneson
Sec., W. E. Kropp, 256 Montgomery St., San Francisco
Gen. Mgr., L. L. Aubert
Asst. Gen. Mgr., H. M. Paulsen
Supt., Jack Brennan, Maricopa
Asst. Supt., L. F. Moore, Maricopa
Ch. Chem., H. F. Ball, Maricopa
Pur. Agt., John C. Penn
Refinery located at Maricopa, Calif.

O

Ocean Refining Co., Kilgore, Tex.
Owners, Jess Weaver, Jack William and T. G. Shepard
Refinery located at Kilgore, Tex.

Ohio Valley Refining Co., 201 Barkwill St., St. Mary's, W. Va.
Pres., J. P. Flynn
V. P., H. J. Crawford
Sec. and Treas., W. R. Reitz
Supt., J. B. Northrop
Tank Car S. M., A. M. Kiester
Ch. Chem., G. R. Dye
Traf. Mgr., H. M. Locke
Pur. Agt., J. B. Northrop
Refinery located at St. Mary's, W. Va.

Oil Creek Refining Co., P.O. Drawer 506, Titusville, Pa.
Pres., J. E. Fleming
V. P., F. J. McGraw
Sec., M. D. Woods
Treas., Geo. F. Fleming
Gen. Supt., F. J. McGraw
Tank Car and Station S. M., M. D. Woods
Pur. Agt., G. L. Ehrhart
Refinery located at East Titusville, Pa.

Oil Refineries, Inc., 325 First National Bank Bldg., Shreveport, La.
Pres., Theodore Hoffacker, New York, N. Y.
V. P.'s, M. J. Grogan, B. P. Crittenden
Sec., H. T. McGown, Fort Worth, Tex.
Treas., T. H. Grobe
Gen. Mgr., B. P. Crittenden
Gen. Supt., J. A. O'Neill, Overton, Tex.
Sales Agts., Grogan Oil Co.
Ch. Chem., Mr. Scharnagel
Refineries located at Overton, Tex., and Haughton, La.

Old Dutch Refining Co., Box 442, Muskegon, Mich.
Pres., John Borden
V. P., G. S. Turner, Jr.
Sec., F. H. Duggan
Treas., G. B. Treloar
Gen. Mgr., John Borden
Gen. Supt., F. J. McCormick
Asst. Supt., C. A. Cromwell
Tank Car S. M., G. S. Turner, Jr.
Station S. M., G. S. Turner, Jr.

Ch. Egr., F. J. McCormick
Ch. Chem., Clyde A. Cromwell
Pur. Agt., G. B. Treloar
Trag. Mgr., John Dalson
Refinery located at Muskegon, Mich.

Olney Oil & Refining Co., 1011 City National Bldg., Wichita Falls, Tex.

Pres., Frank Kell
V. P., J. A. Kell
Sec. and Treas., R. G. Cocanower
Gen. Mgr., R. G. Cocanower
Gen. Supt., P. E. Slater
Tank Car S. M., R. G. Cocanower
Refinery located at North Olney, Tex.

Olympic Refining Co., 2425 California St., Long Beach, Calif.

Pres and Gen. Mgr., Charles P. Ritter
Sec. and Treas., D. T. Buckley
Refinery located at Long Beach, Calif.

Omar Refining Co., Roberts Bldg., Tulsa, Okla.

Pres., F. S. Whitaker
V. P., J. H. Whitaker
Sec. and Treas., M. H. Collins
Gen. Supt., H. L. Welton
Tank Car S. M., J. H. and F. S. Whitaker
Ch. Chem., C. J. Gosselin
Pur. Agt., H. L. Welton
Traf. Mgr., V. C. Gibson
Refinery located at Garber, Okla.

Oreana Refining Co., La Barge, Wyo.

Sole owner, Harold Riley
Supt., S. Grinch
Refinery located at La Barge, Wyo.

Oriental Oil Co., 1911½ Pacific Ave., Dallas, Tex.

Pres., W. R. Smith
V. P. and Gen. Mgr., Frank M. Smith
Sec. and Treas., D. C. White
Gen. Mgr., Frank M. Smith
Gen. Supt., W. T. Evans
Tank Car S. M., B. H. Pitman
Station S. M., M. T. Smith
Ch. Egr., J. D. Scruggs
Ch. Chem., W. T. Evans
Pur. Agt., B. H. Pitman
Traf. Mgr., B. H. Pitman
Refinery located at West Dallas, Tex.

Osage Refining Co., Osage, Wyo.

Pres., E. C. Winters, 908 Midland, Kansas City, Mo.
Sec. and Treas., R. E. Cunningham, Kansas City, Mo.
Gen. Supt., C. Hunter
Refinery located at Osage, Wyo.

Ouachita Valley Refining Co., P.O. Box 610, El Dorado, Ark.

Pres., John E. Shatford
Sec., E. B. Wall
Treas., C. L. Crenshaw
Gen. Supt., John E. Shatford
Asst. Supt., H. J. Shatford
Tank Car S. M., C. L. Crenshaw
Ch. Egr., John E. Shatford
Pur. Agt., C. L. Crenshaw
Traf. Mgr., C. L. Crenshaw
Refinery located at El Dorado, Ark.

Outdoor Refining Co., Kilgore, Tex.

Owners, A. Batkins, J. H. Bishop and J. McAlister
Refinery located at Kilgore, Tex.

Overton Refining Co., Overton, Tex.

Pres., J. D. Wrather
Treas., John Wrather
Sec., G. C. Walters
Refinery located at Overton, Tex.

Ozozo Refining Co., Friar Switch, Tex.

Owner, J. I. Staley
Refinery located at Friar Switch, Tex.

P

Panama Refining Co., Kilgore, Tex.

Pres., A. F. Anding
V. P. and Treas., A. Fanding
Sec., W. H. Sanders
Gen. Supt., M. B. Taylor
Tank Car S. M., John E. Stephens
Ch. Chem., J. P. Stepp
Pur. Agt., Tom Potter
Refinery located at Kilgore, Tex.

Pan American Petroleum & Transport Co., 122 East Forty-second St., New York City (Subsidiary of Standard Oil Co. of Indiana)

Chm., E. G. Seubert
V. Chm., Dr. R. E. Wilson
Asst. to V. Chm., E. G. McKeever
Pres., Louis Blaustein
V.P.s, Jacob Blaustein, J. A. Carroll, Jr., J. S. Wood, C. F. Hatmaker
Sec., D. H. Baker
Treas., J. A. Carroll, Jr.
Asst. Sec. and Treas., A. N. Penn
Gen. Supt., D. J. Smith
Supts., W. W. Hulin, Baltimore, Md.; H. T. Hulin, Savannah, Ga.; P. J. Sweeney, Texas City, Tex.
Asst. Supts., William Mellendick, Baltimore, Md.; H. J. Broderson, Texas City, Tex.
Traf. Mgr., J. S. Wood
Pur. Agt., J. A. Whitely
Refineries located at Baltimore, Md.; Savannah, Ga., and Texas City, Tex.

Pan American Southern Corp., Canal Bank Bldg., New Orleans, La.

Pres., E. G. McKeever
V. P.s, A. E. Ralston, J. A. Carroll, Jr.
Sec., D. H. Baker
Treas., J. A. Carroll, Jr.
Asst. Sec. and Treas., A. N. Penn
Gen. Supt., D. J. Smith
Supt., F. W. Grey, Destrehan, La.
Pur. Agt., J. A. Whitely
Traf. Mgr., J. S. Wood
Refinery located at Destrehan, La.

Panhandle Refining Co., Wichita Falls, Tex.

Pres., Roy B. Jones
V. P.s, R. C. Stanford, M. A. Chambers, G. W. Reed
Sec., H. F. Bennett
Treas., M. A. Chambers
Gen. Mgr., Roy B. Jones
Gen. Supt., W. F. Sims
Asst. Supts., W. R. Ellis, Wichita Falls, Tex., and R. Jacobs, Kings Mill, Tex.
Ch. Chem., E. W. Ellis
Tank Car and Station S. M., G. W. Reed
Ch. Egr., W. F. Sims
Ch. Chem., W. R. Ellis
Pur. Agt., W. H. Cook
Traf. Mgr., J. H. Davenport
Refineries located at Wichita Falls, Tex., and Kings Mill, Tex.

Paraffine Companies, The, Inc., 475 Brannan St., San Francisco, Calif.

Pres., R. S. Shainwald
V. P., W. H. Lowe
Sec., R. Ohea
Treas., R. H. Shainwald
Gen. Mgr., W. H. Lowe
Supt., O. H. Robertson, Emeryville, Calif.
Ch. Egr., J. T. Coleman
Ch. Chem., O. H. Robertson
Pur. Agt., A. H. Silverstone
Traf. Mgr., A. W. Brown
Refinery located at Emeryville, Calif.

Paragon Refining Co., Leuders, Tex.

Pres., J. C. Hester
V. P., J. W. Hampton
Sec. and Treas., Mrs. L. Butler
Gen. Mgr., J. C. Hester
Gen. Supt., Leon Counts
Sales Mgr., J. C. Hester
Refinery located at Leuders, Tex.

Paramount Refineries, San Angelo, Tex.

Pres., W. B. Hagan
V. P., H. O'Bannon
Sec. and Treas., C. O. Harris
Supt., Jack Strickler
Asst. Supt., Lee Strickler
Ch. Egr., J. Barnett
Station S. M., Jay Wills
Refinery located at San Angelo, Tex.

Pacotex Petroleum Co., 225 Bush St., San Francisco, Calif.

Pres., K. R. Kingsbury
V. P.s, H. D. Collier, R. W. Hanna, A. S. Russell
Sec., J. H. Tuttle
Treas., V. F. Palmer
Refinery located at El Paso, Tex.

Pecos Diamond Refining Co., Inc., Artesia, N. Mex.

Pres., G. A. Grober
V. P., I. M. Grober
Sec. and Treas., Henry W. Harriman
Gen. Mgr., G. A. Grober
Gen. Supt., G. A. Grober
Ch. Egr. and Chem., Ed Millard
Refinery located at Artesia, N. Mex.

Peninsula Oil Co., Port Clinton, Ohio

Pres., C. W. Underwood
V. P., G. J. Becker
Sec. and Treas., R. L. Heufert
Gen. Mgr., C. W. Underwood
Refinery located at Catawba Island, Ottawa County, Ohio

Pennant Refining Co., Kilgore, Tex.

Owner, J. C. Calloway
Refinery located at Kilgore, Tex.

Pennsylvania Oil Products Refining Co., Warren, Pa.

Pres., M. F. Cowden
V. P., G. E. Muir
Sec., H. E. Lawrence
Treas., D. F. Cowden
Gen. Mgr., M. F. Cowden
Gen. Supt., S. P. Stannard
Tank Car and Station S. M., H. S. Hayden
Refinery located at Eldred, Pa.

Pennsylvania Refining Co., Butler, Pa.

Pres., John A. Beck
V. P.s, A. B. Weingard, W. K. Glenn
Sec. and Treas., Paul R. Beck
Gen. Mgr., W. W. Beck
Supts., G. W. Kirkwood, Karns City, Pa.; Adam Mosher, Titusville, Pa.
Tank Car S. M., M. H. Hindman
Ch. Chem., James Eisler
Traf. Mgr., W. S. Schoenfeld
Refineries located at Karn City and Titusville, Pa.

Pennzoil Co., Drake Bldg., Oil City, Pa.

Pres., C. L. Suhr
V. P.s, J. F. Vandeventer, W. S. Zehrung
Sec., D. J. Cavanaugh
Treas., M. A. Brewster
Gen. Mgr., W. S. Zehrung
Gen Supt., L. D. Fulton
Asst. Supts., J. M. Hinman, D. J. Harvey
Lub. Oil S. M., B. S. Phillips
Tank Car S. M., R. A. Browne
Station S. M., W. R. Birkmayr
Ch. Egr., P. M. Robinson
Ch. Chem., Dr. G. O. Ebrey
Pur. Agt., A. W. Clinger
Traf. Mgr., D. E. Carrier
Refinery located at Oil City, Pa.

Petrol Corp., 4020 Bandini Blvd., Los Angeles, Calif.

Pres., Edwin W. Pauley
V. P., Harold R. Pauley
Sec., James P. Fitzpatrick
Treas., Percy F. Cartzdafner
Gen. Supt., Geo. E. Miller
Asst. Supt., Norman Tyacke
Gasoline S. M., Wm. A. Burns
Fuel Oil S. M., W. J. Mintline
Ch. Chem., Ralph Tarshis
Pur. Agt., Harold R. Pauley
Traf. Mgr., A. S. Hovey
Refinery located at Los Angeles, Calif.

Petroleum Products Co., Chanute, Kans.

Pres., Frank Young
V. P., P. F. Mote
Sec. and Treas., H. B. Williams
Gen. Mgr., H. B. Williams
Supt., B. C. Kiplinger
Sales Mgr. and Pur. Agt., H. B. Williams
Refinery located at Chanute, Kans.

Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.

Pres., Frank Phillips
V. P.s, John H Kane, Wm. N. Davis, C. P. Dimit, H. E. Koopman, J. M. Sands, R. H. Lynn, G. G. Oberfell, H. A. Trower, F. E. Rice, C. R. Musgrave, M. P. Youker
Sec. and Treas., O. K. Wing
Mgr. of Refineries, M. P. Youker
Asst. Mgr. of Refineries, W. G. Hiatt
Supts., Hugh Miller, Borger, Tex.; J. W. Mitchell, Kansas City, Kans.; R. D. Evans, Okmulgee, Okla.
Marketing Dept., H. A. Trower, Jr.
Gen. Sales Mgr., A. M. Hughes
Tank Car S. M., H. A. Gardner
Pur. Agt., H. E. Koopman
Traf. Dept., C. R. Musgrave in charge
Traf. Mgr., E. C. Kitching
Refineries located at Borger, Tex.; Kansas City, Kans., and Okmulgee, Okla.

Phoenix Refining Co., Inc., P.O. Box 5055, Dallas, Tex.

Pres., Raymond R. Russell
V. P., Dr. Daniel Russell
Sec., Mrs. R. R. Russell
Gen. Mgr., E. E. Wallace
Supt., J. F. Muense, Dallas; J. H. Hall, Pettus
Refineries located at Dallas and Pettus, Tex.

Pilgrim, Inc., Ardmore, Okla

Pres., Walter Neustadt
V. P., Max Westheimer
Sec. and Treas., D. W. Neustadt
Supt., M. Blakley
Refinery located at Kingston, Okla.

Pioneer Oil & Refining Co., 604 Carolina St., San Antonio, Tex.

Pres., A. B. Slimp
Sec. and Treas., M. L. Roark
Supt., H. B. Slimp
Asst. Supt., J. P. McFarland
Tank Car S. M., A. B. Slimp
Station S. M., J. S. Coope
Ch. Egr., H. B. Slimp
Ch. Chem., A. I. Robertson
Traf. Mgr., A. W. Nunn
Refinery located at Somerset, Tex.

Plainview Refining Co., Plainview, Tex.

Pres., J. C. Hooper
V. P., J. N. Jordan
Sec. and Treas., O. D. Byrd
Gen. Mgr., E. M. Corah
Supt., L. A. Martin
Asst. Supt., J. C. Yeager
Sales Mgr., E. M. Corah
Pur. Agt., O. D. Byrd
Traf. Mgr., E. M. Corah
Refinery located at Plainview, Tex.

Pope Refining Co., Gladewater, Tex.

Owner, S. B. Pope
Refinery located at Gladewater, Tex.

Posolube Refining Co., 4011 Bandini Blvd., Los Angeles, Calif.

Pres., G. A. Lathrope
V. P., O. Lockhart
Sec., W. P. Davenport
Treas., H. Breuster
Gen. Mgr., G. A. Lathrope
Supt., W. P. Davenport
Sales Mgr., W. P. Davenport
Ch. Chem., J. Lauretzien
Pur. Agt., W. P. Davenport
Refinery located at Los Angeles, Calif.

Producers Oil & Refining Co., Kilgore, Tex.

Owner, A. F. Anding
Refinery located at Kilgore, Tex.

Pure Oil Co., 35 East Wacker Drive, Chicago

Pres., H. M. Dawes
V. P.s, C. B. Watson, R. W. McIlvaine, N. H. Weber, W. E. Hutton, F. S. Heath
Sec., L. S. Wescoat
Treas., Rawleigh Warner
Gen. Supt., R. C. Osterstrom, Asst. to C. B. Watson
Supts., K. B. May, Midland, Mich.; E. E. McPherson, Heath, Ohio; J. R. Palmer, Cabin Creek, W. Va.; G. T. Yost, Muskogee, Okla.; R. L. Vernor, Smith's Bluff, Tex.; E. A. McCadden, Marcus Hook, Pa.; O. B. Wendeln, Toledo, Ohio
Asst. Supts., J. C. Megraw, Cabin Creek, W. Va.; J. S. Allen, Smith's Bluff, Tex.; J. J. Grace, Marcus Hook, Pa.; H. L. Smith, Toledo, Ohio
Tank Car S. M., R. H. McElroy, Jr.
Station S. M., G. C. Morris
Ch. Egr., D. E. Sullivan
Ch. Chem., C. R. Wagner

Pur. Agt., G. L. Parsons
Traf. Mgr., H. Hauseman
Refineries located at Midland, Mich.; Heath, Ohio; Cabin Creek, W. Va.; Muskogee, Okla.; Smith's Bluff, Tex.; Marcus Hook, Pa., and Toledo, Ohio

Q

Quaker State Oil Refining Corp., Chambers Bldg., Oil City, Pa.
Pres., H. J. Crawford
V. P.s, S. Messer, James D. Berry
Sec. and Asst. Treas., W. R. Reitz
Treas. and Asst. Sec., Charles D. Berry
Gen. Supt., G. B. Hunter
Supts., E. E. Ebner, Emlenton, Pa.; W. H. Rockman, Farmers Valley, Pa.
Tank Car S. M., A. R. Newton, Jr., Emlenton; K. B. Ogilvie, Farmers Valley.
Refineries located at Emlenton, Pa., and Farmers Valley, Pa.

R

Rado Refining & Producing Co., McAllen, Tex.
Pres., Walter K. Campbell
V. P., H. B. May, Fort Worth, Tex.
Sec., O. B. Stevens, Fort Worth, Tex.
Treas., James E. Campbell
Refinery located at McAllen, Tex.

Raven Oil & Refining Co., Rangely, Colo.
Pres., J. W. Leonard
V. P., F. G. Cary
Sec. and Treas., R. A. Bryson
Gen. Mgr., R. A. Bryson
Gen. Supt., M. M. Cook
Pur., Agt., R. A. Bryson
Refinery located at Rangely, Colo., (Products marketed by Continental Oil Co.)

Red River Refining Co., Inc., 4323 S. Western Blvd., Chicago, Ill.
Pres., P. B. Flynn
V. P., J. P. Goodrich
Sec. and Treas., R. S. Watt
Supt., C. A. Harris, Burnham, Ill.
Ch. Egr., R. U. Becknell
Ch. Chem., J. E. Schulze
Pur., Agt., C. A. Harris
Traf. Mgr., John Hayden
Refinery located at Burnham, Ill.

Republic Oil Refining Co., Second National Bank Bldg., Houston, Tex
Pres., O. D. Robinson
V. P.s, J. O. Corner, D. W. Hovey, W. E. Huston
Sec. and Treas., W. H. Moreland
Gen. Mgr., O. D. Robinson
Gen. Supt., D. W. Hovey
Supt., C. E. Robertson
Asst. Supt., C. C. Evans
Tank Car and Station S. M., J. O. Corner
Ch. Egr., Louis Keller
Ch. Chem., Fred Sanberg
Pur. Agt., E. L. Saver
Traf. Mgr., O. R. Eytel
Refinery located at Texas City, Tex.

Rex Oil Refinery, Inc., Rapid City, S. Dak.
Pres., Geo. P. Hurst
V. P., Ray Monner
Treas. and Gen. Mgr., G. M. Lewis
Ch. Egr., Elmer Ratcliff
Ch. Chem., R. J. Monner
Refinery located at Rapid City, S. Dak.

Rice Ranch Oil Co., 262 South Los Angeles St., Los Angeles, Calif.
Pres., W. Litchenberger
Sec., H. G. Phillips
Refinery located at Santa Maria, Calif.

Richfield Oil Co. of California, Richfield Bldg., Los Angeles, Calif.
Receiver, William C. McDuffie
Gen. Supt., A. M. Kelley
Supt., R. A. Panero, Wilmington, Los Angeles County, Calif.
Gen. Sales Mgr., R. W. Walsh
Ch. Egr., David E. Day
Ch. Chem., C. K. Hewes
Pur. Agt., B. J. Mahaffy
Traf. Mgr., W. O. Narry
Refineries—Watson refinery, Hynes refinery, Los Angeles, Bakersfield (the two latter shut down)

Rio Grande Oil Co., 417 South Hill St., Los Angeles, Calif. (Controlled by Consolidated Oil Corp.)
Pres., H. R. Gallagher
V. P.s, C. S. Jones, Frank A. Morgan
Sec. and Treas., M. R. Gross
Gen. Mgr., C. S. Jones
Gen. Supt., J. J. Downey
Supt., William Murray, Vinvale, Calif.
Dir. of Sales, H. E. Britzman
Gen. Sales Mgr., H. H. Harris
Ch. Chem., M. Bach
Pur. Agt., H. H. Kelly
Traf. Mgr., A. L. Sarrels
Refinery located at Vinvale, Calif.

River Dome Refinery, 724 First St., East, Round Up, Mont.
Pres., L. R. Carroll
V. P., S. A. Grouse
Sec., H. J. Carroll
Treas., L. R. Carroll
Supt. Ref., L. R. Carroll
Refinery located at Round Up, Mont.

Rock Island Refining Co., Oklahoma Bank Bldg., Duncan, Okla.
Pres., L. B. Simmons
V. P.s, L. E. Kincannon, E. J. Glover, O. W. Simmons
Sec. and Treas., W. Witt
Gen. Mgr., L. B. Simmons
Supt., A. L. Rayburn, Beckett, Okla.
Asst. Supt., A. R. Love, Beckett
Tank Car S. M., E. J. Glover
Station S. M., E. J. Glover
Ch. Egr., Emory M. Skinner
Ch. Chem. C. V, May
Pur. Agt. and Traf. Mgr., R. H. Roper
Refinery located at Beckett, Okla.

Roco Refining Co., Kilgore, Tex.
Owner, Lewis Cohen
Refinery located at Kilgore, Tex.

Roosevelt Oil Co., P. O. Box 168, Mount Pleasant, Mich.
Pres., C. L. Maguire
V. P., T. F. Caldwell
Sec. and Treas., S. M. Fasquelle
Gen. Mgr., C. L. Maguire
Supt., E. R. Hively
Asst. Supt., D. Y. Hewitt
Station S. M., T. F. Caldwell
Tank Car S. M., T. F. Caldwell
Ch. Chem., Wm. B. Howard, Jr.
Pur. Agt., J. W. C. McKee
Traf. Mgr., B. E. Kothe
Refinery located at Mount Pleasant, Mich.

Root Refining Co., 1000 Commercial Bank Bldg., Shreveport, La.
Pres., D. P. Hamilton
V. P., Horace Canon
Sec., T. E. Beaird
Treas., L. C. Hallonquist
Gen. Mgr., D. P. Hamilton
Supt., Ed Kimes, El Dorado, Ark.
Asst. Supt., John Brown, El Dorado
Tank Car S. M., D. A. Brown
Ch. Egr., R. T. Colquette
Ch. Chem., T. L. McNamara
Pur. Agt., T. E. Beaird
Traf. Mgr., A. L. Aycock
Refinery located at El Dorado, Ark.

Rusk Oil & Refining Co., Box 270, Tyler, Tex.
Pres., H. H. Coffield
V. P., George P. Mann
Sec. and Treas., J. H. Edwards
Gen. Supt., George P. Mann
Sales Mgr., J. H. Edwards
Refinery located at Overton, Tex.

Russell Oil Co., 642 Utah Ave., Butte, Mont.
Pres., Mrs. Joseph Russell
Sec., Ludwig Renland
Treas., Peter Aarrestad
Gen. Mgr., Fred Woodhull
Gen. Supt., Wilfred Trethewey
Supt., Wilfred Trethewey, Billings; John Hoen, Butte
Asst. Supts., Pete Aarrestad, Butte; John Oakland, Billings
Tank Car S. M., Ray Evans
Station S. M., Jess Stewart
Ch. Egr., Abner Kolstead
Ch. Chem., Arnold Bjorneby
Pur. Agt., Mrs. Joseph Russell
Refineries located at Butte and Billings, Mont.

S

Sabine Refining Co., Gladewater, Tex.
Owner, John Kraker
Refinery located at Gladewater, Tex.

Samuel, J. Howard, Refinery, P.O. Box 304, Coleman, Tex.
Pres., Howard Samuell
V. P.s, C. L. Mattocks, Claude Morris
Sec. and Treas., R. A. Hodges
Gen. Supt., Jack Gracey
Tank Car S. M., Howard Samuell
Pur. Agt., R. A. Hodges
Refinery located at Coleman, Tex.

San Fernando Refining Co., Box I, San Fernando, Calif.
Pres., J. O. Moffett
Gen. Mgr., J. O. Moffett
Supt., Wm. D. Parks
Asst. Supt., L. D. Haworth
Station S. M., Courtney Clarke
Ch. Chem., L. D. Haworth
Pur. Agt., E. A. Ericson
Refinery located at Newhall, Calif.

Seal Beach Refining Co., Seal Beach, Calif.
Refinery located at Seal Beach, Calif.

Seaside Oil Co., Summerland, Calif.
Pres., A. M. Heineman
V. P., J. F. Bushnell
Sec., M. W. O'Brien
Treas., J. F. Bushnell
Supts., D. C. Peet, Ventura, Calif.; D. Searles, Summerland
Tank Car S. M., J. F. Bushnell
Station S. M., Winslow Bushnell
Pur. Agt., E. H. Beresford
Refineries located at Ventura and Summerland, Calif.

Shamrock Oil & Gas Co., 602 Amarillo, Bldg., Amarillo, Tex.
Pres., John J. Sheerin
V. P.s, H. C. Fownes II, R. T. Wilson
Sec., W. E. Motheral
Treas., J. B. Orr
Gen. Mgr., John J. Sheerin
Gen. Supt., E. C. Will
Supts., H. B. Wade, Meldavis (Lefors), Tex.; R. S. Mims, Sunray, Tex.
Tank Car and Station S. M., N. E. Schneider
Ch. Egr., E. N. Armstrong
Refineries located at Meldavis (Lefors), Tex., and Sunray, Tex.

Shell Oil Co., 100 Bush St., San Francisco, Calif. (Subsidiary of Shell Union Oil Co.)
Pres., S. Belither.
V. P.s, E. F. Davis, J. U. Stair, D. Heggie, A. E. Lacomble, W. F. Durkee, Jr.
Sec., A. R. Bradley
Treas., D. Heggie
V. P. in Chg. Ref., A. E. Lacomble
Supts., D. M. Day, Martinez and Coalinga, Calif.; C. O. F. Jenkin, Wilmington and Dominguez, Calif.
Gen. Sales Mgr., L. T. Kittinger
Ch. Egr., N. W. Thompson
Pur. Agt., J. C. Storey
Traf. Mgr., C. E. Donaldson
Refineries located at Martinez, Coalinga, Wilmington and Dominguez, Calif.

Shell Petroleum Corp., Shell Bldg., St. Louis, Mo. (Subsidiary of Shell Union Oil Corp.)
Pres., Alexander Fraser
V. P.s, Richard Airey, H. H. Anderson, G. S. Rollin, T. E. Swigart, J. W. Watson, R. P. Bascom, A. J. Galloway
V. P. Exploration, W. van Holst Pellekaan
V. P. Sales, L. Van Eeghen
V. P. Mfg., J. F. M. Taylor
Sec., P. R. Chenoweth
Treas., J. W. Watson
Mgr. of Ref., R. B. High
Supts., Dr. H. S. Waser, Wood River, Ill.; F. S. Clulow, East Chicago, Ind.; W. Mullemeister, Houston, Tex.; R. C. Roberts, Arkansas City, Kans.; P. E. Foster, Norco, La.
Asst. Supts., H. A. Stiles, Wood River, Ill.; J. L. Miller, East Chicago, Ind.; T. G. Elder, Houston, Tex.; P. E. Hurley, Arkansas City, Kans.; W. G. Horstman, Norco, La.
Tank Car S. M., R. D. Ebbert
Bulk Depots S. M., D. E. Lauin
Station S. M., H. E. Hall
Ch. Egr., S. Peterson
Ch. Chems., E. T. Travis, Wood River; E. B. Ayers, East Chicago; R. Palmer, Norco; R. C. Rich, Houston; L. C. Burroughs, Arkansas City.
Pur. Agt., C. B. Singleton
Traf. Mgr., E. W. Sieboldt
Refineries located at Wood River, Ill.; East Chicago, Ind.; Houston, Tex.; Arkansas City, Kans., and Norco, La.

Shore Line Refining Co., Kilgore, Tex.
Owner, A. V. Riley
Refinery located at Kilgore, Tex.

Signal Oil & Gas Co. of California, 811 W. Seventh St., Los Angeles, Calif.
Pres., S. B. Mosher
V. P.s, R. H. Green, O. W. March
Sec., H. J. March
Treas., J. H. Roonsauell
Ch. Egr., G. L. Young
Pur. Agt., J. H. Thies
Refinery located at Hynes, Calif.

Simms Oil Co., 1007 Magnolia Bldg., Dallas, Tex.
Pres., Edward T. Moore
V. P., F. R. Schneider
Sec., L. W. Richards
Treas., D. H. Voss
Gen. Mgr., Edw. T. Moore
Gen. Supt., I. H. Lance
Tank Car S. M., F. R. Schneider
Ch. Egr., Frank Gardner
Ch. Chem., H. L. Kerr
Traf. Mgr., J. W. Ricker
Refineries located at Dallas, Tex., and Smackover, Ark.

Simrall Refining Corp., 511 Union Central Bldg., Cincinnati, Ohio
Pres., W. F. Simrall
V. P., R. P. Crothers
Sec. and Treas., A. A. Buschle
Gen. Mgr., W. F. Simrall
Ch. Egr., R. P. Crothers
Traf. Mgr., B. E. Kothe
Supt., E. H. Crawley, Horse Cave, Ky.
Refinery located at Horse Cave, Ky.

Sinclair Refining Co., 45 Nassau St., New York, N. Y. (Subsidiary of Consolidated Oil Corp.)
Chm. Board, H. F. Sinclair
V. Chm. Board, H. R. Gallagher
Pres., E. W. Sinclair
Asst. to Pres., Daniel J. Pierce
V. P.s, J. W. Carnes, J. M. O'Day, Sheldon Clark, M. L. Gosney, H. L. Phillips, J. F. Farrell, E. W. Isom, L. V. Stanford, Geo. H. Taber, Jr.
Asst. Sec., O. M. Gerstung
Treas., J. F. Farrell
V. P. Chg. Ref., George H. Taber, Jr.
Gen. Supt., George R. Lord
Ch. Egr., J. S. Hess
Ch. Chem., E. B. Phillips
Pur. Agt., H. B. Malone
Traf. Mgr., J. M. O'Day
Tank Car and Sta. S. M., J. W. Carnes
Refineries located at East Chicago, Ind.; Coffeyville, Kans.; Houston, Tex.; Marcus Hook, Pa.; Wellsville, N. Y.; Sand Springs, Okla.; Fort Worth, Gladewater and El Paso, Tex., and Kansas City, Kans.

Skelly Oil Co., Skelly Bldg., Tulsa, Okla.
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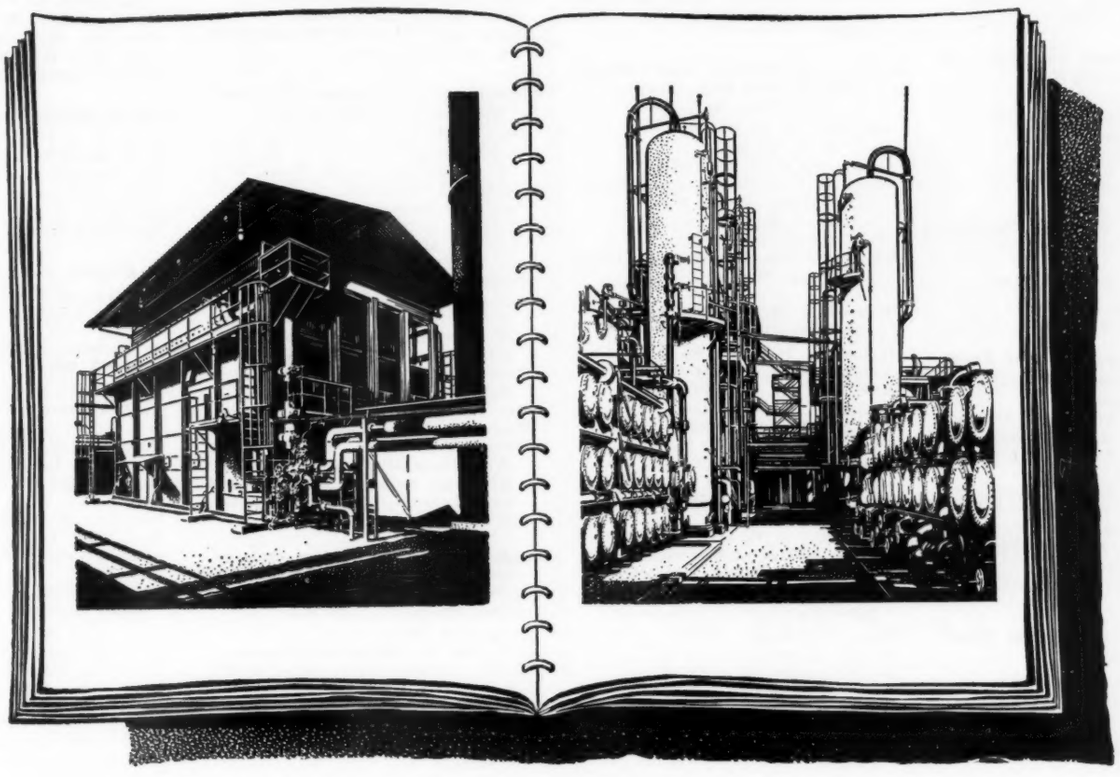
V. P.s, H. M. Stalcup, C. C. Herndon, W. T. Atkins, R. T. Lyons, Emby Kaye
Sec. and Treas., F. T. Hopp
Gen. Mgr., W. G. Skelly
Gen. Supt., Emby Kaye
Sales Mgr., W. T. Atkins
Tank Car S. M., E. F. Underwood



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Asst. Supt., H. V. Smith, Eldorado
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Pur. Agt., F. W. Robertson
Traf. Mgr., A. F. Winn
Tank Car and Station S. M., John R. Bailey
Mgr. Research Dept., R. W. Leslie
Refinery located at Eldorado, Kans.

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V. P.s, W. J. Sloan, P. H. Zook
Sec., C. T. Rickerson
Treas., W. J. Sloan
Gen. Mgr., Paul H. Zook
Gen. Supt., Paul Tinkler
Asst. Supt., Earl Dorrance
Tank Car S. M., Walter H. Murphy
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Snow Cap Oil Co., Sunburst, Mont.
Sole Owner, Adam J. Eulberg
Refinery located at Sunburst, Mont.

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V. P.s, Wiley Blair, Jr., Colorado Springs, Colo.; Ralph S. Young, Colorado Springs, Colo.; J. H. Grimes
Sec., Paul Fussell
Treas., P. J. Hallicy, Huntington Beach
Supt., J. H. Grimes
Sales Mgr., F. M. Moore
Pur. Agt., J. H. Grimes
Refinery located at Huntington Beach, Calif.

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Chm. Bd., H. L. Pratt
Pres., C. E. Arnott
V. P.'s, E. R. Brown, A. F. Corwin, Frederick Ewing, F. S. Sales, C. L. Jones, H. F. Sheets.
Sec., W. D. Bickham
Treas., F. S. Fales

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Sec., Henry Fisher
Treas., Richard P. Tinsley
Gen. Supt., Wilbur F. Burt
Supts., A. E. Esser, Sone & Fleming, Brooklyn; R. B. Malone, Pratt Works, Long Island City; R. T. Lockwood, Buffalo Refinery; C. W. Schaffer, Providence Refinery
Asst. Supts., W. J. Mooney and F. W. Hadley, Sone & Fleming, Brooklyn; J. C. Allen, Pratt Works, Long Island City; F. S. Ford, Buffalo; H. A. Rickett, Providence
Tank Car and Station S. M., Frederick Ewing
Ch. Egr., C. A. Ellis
Ch. Chem., Dr. J. B. Rather
Pur. Agt., J. R. Taylor
Traf. Mgr., L. H. Benner
Refineries—Sone & Fleming, Brooklyn; Pratt Works, Long Island City and Brooklyn; Buffalo; Providence

Vacuum Oil Co., Inc., 26 Broadway, New York City, N. Y.
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V. P.s, C. W. Hadley, C. L. Jones
Sec., G. V. Holton
Treas., R. P. Tinsley
Supts., J. F. Turner, Olean, N. Y.; J. S. McElfresh, Paulsboro, N. J.
Asst. Supts., W. E. Wanner, Olean; D. L. Hooker, Paulsboro
Pur. Agt., J. R. Taylor
Refineries located at Olean, N. Y., and Paulsboro, N. J.

Lubrite Division, 4140 Lindell Blvd., St. Louis, Mo.
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Gen. Supt., D. A. Windsor
Supt., Chas. Bettman, E. St. Louis
Asst. Supt., James Mickey, E. St. Louis
Marketing Mgr., W. H. Ware
Tank Car S. M., Earl Whatley
Ch. Egr., R. A. Frevert
Ch. Chem., L. T. Doiron
Pur. Agt., J. H. MacCrea
Traf. Mgr., O. E. Kuster
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Gen. Mgr., L. L. Marcell
Mgr., R. R. Irwin
Gen. Supt., E. C. Marshall
Supts., C. C. Durkee, Augusta, Kans.; J. W. Glass, Casper, Wyo.
Ch. Egr., G. S. Dunham
Ch. Chem., H. L. Bedell
Refineries located at Augustn, Kans., and Casper, Wyo.

White Star Division, 903 W. Grand Blvd., Detroit, Mich.
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Asst. Gen Mgr., C. B. McCollough
Exec. Asst., H. M. Sullivan
Gen. Supt., J. B. Edwards
Supt., S. G. Keller, Trenton, Mich.
Tank Car S. M., L. T. Morrow
Station S. M., C. B. White
Ch. Egr., C. R. Miller
Ch. Chem., Dr. E. H. Potthoff
Pur. Agt., J. G. Pyke
Traf. Mgr., J. C. O'Brien
Refinery located at Trenton, Mich.

Southern Oil Refining Co., Swann Bldg., Tyler, Tex.
Pres., L. H. Gray
V. P., J. G. Gray
Sec., N. L. Webster
Treas., C. E. McKay
Gen. Mgr., L. H. Gray
Supt., C. L. Harriman, Reeds, Tex.
Tank Car and Station S. M., N. L. Webster
Traf. Mgr., N. L. Webster
Pur. Agt., N. L. Webster
Refinery located at Reeds, Tex.

South Kentucky Pipe Line Co., Somerset, Ky.
Pres., R. C. Snyder
V. P., H. B. Wood
Sec. and Treas., Earl R. Tate
Gen. Supt., Dexter Parmley
Tank Car S. M., A. R. Anderson
Station S. M., L. I. Longsworth
Refinery located at Somerset, Ky

Southport Refining Co., Kilgore, Tex.
Owner, Marion Travis
Refinery located at Kilgore, Tex.

Spartan Refining Co., Inc., Atlas Bldg., Shreveport, La.
Pres., E. R. Ratcliff
V. P., B. H. Gray
Gen. Supt., D. H. Christman
Asst. Supt., C. P. Christman
Tank Car S. M., Pleas O. Hardwick
Ch. Egr., D. L. Edmonson
Ch. Chem., H. O. Sivess
Pur. Agt., M. W. Bass
Traf. Mgr., F. H. Walker
Refinery located at Shreveport, La.

St. Helens Petroleum Co., Ltd., 1031 S. Broadway, Los Angeles, Calif.
Chm., Charles B. Stocken
Directors, William Ivey, A. F. Strickland, G. W. Ivey
Sec., R. H. Young, London, England; L. A. Sec., A. P. McEachern
Gen. Mgr., Charles Drader
Supt., C. Z. Webb, Pico, Calif.
Asst. Supt., G. W. Spark, Pico, Calif.
Tank Car and Station S. M., M. F. Dolan
Pur. Agt., H. C. Drader
Traf. Mgr., R. M. Kennett
Refinery located at Pico, Calif.

Standard Oil Co. of California, 225 Bush St., San Francisco, Calif.
Pres., K. R. Kingsbury
V. P.s, W. H. Berg, Oscar Sutro, R. W. Hanna, H. D. Collier
Sec., J. H. Tuttle
Treas., V. F. Palmer
Gen. Supt., A. F. Brooks
Supts., H. C. Hanna, El Segundo; C. F. Finney, Richmond; J. F. Faber, Bakersfield
Ch. Egr., H. H. Hall
Ch. Chem., J. B. Terry
Pur. Agt., F. D. Bryant
Traf. Mgr., A. R. Slingerland
Sales Mgr., H. B. Fairchild
Refineries located at El Segundo, Richmond, Bakersfield.

Standard Oil Co. (Indiana), 910 South Michigan Ave., Chicago, Ill.
Pres., E. G. Seubert
V. P.s, Allan Jackson, C. J. Barkdull, R. H. McElroy, A. W. Peake, E. J. Bullock, M. G. Paulus.
Sec., F. T. Graham
Treas., C. J. Barkdull
Gen. Mgr. Mfg., M. G. Paulus
Gen. Supt., H. F. Glair
Supts., E. J. Shaeffer, Whiting, Ind.; S. A. Montgomery, Wood River, Ill.; G. H. Moffett, Sugar Creek, Mo.; H. R. Snow, Neodesha, Kans.; R. E. Beard, Casper, Greybull, Wyo.
Tank Car and Station S. M., Amos Ball
Pur. Agt., E. J. Bullock
Traf. Mgr., R. H. McElroy
Refineries located at Whiting, Ind.; Wood River, Ill.; Sugar Creek, Mo.; Neodesha, Kans.; Casper, Greybull and Laramie, Wyo.; Zilwaukee, Mich.

Standard Oil Co. of Louisiana, 2134 St. Charles Ave., New Orleans, La. (Subsidiary of Standard Oil Co. of New Jersey)
Pres., J. C. Hilton
V. P., Sec. and Treas., A. K. Gordon
V. P. and Gen. Mgr. Sales, J. E. Skehan
V. P. and Gen. Mgr. Mfg., H. H. Hewetson, Baton Rouge
Gen. Supt., M. J. Rathbone, Baton Rouge
Pur. Agt., W. N. Cottrell
Traf. Mgr., R. W. J. Flynn
Refinery located at Baton Rouge, La.

Standard Oil Co. of New Jersey, 26 Broadway, New York City, N. Y.
Pres., F. W. Abrams
V. P.s, Chester F. Smith, C. G. Sheffield
Sec., M. H. Eames
Treas., R. P. Resor
Gen. Mgrs., J. R. Carringer, Northern Refineries; E. A. Rudigier, Southern Refineries
Supts., M. R. Meacham, Linden, N. J.; S. J. Tydeman, Bayonne, N. J.; W. A. Eberle, Jersey City; E. A. Ridigier, Baltimore; George W. Thompson, Parkersburg; J. E. Lenhardt, Charleston
Tank Car S. M., E. A. Holbein
Retail S. M., C. G. Sheffield
Wholesale Sales Mgr., J. E. Skehan
Staff Egr., C. L. Waite
Ch. Chem., H. G. Burks, Jr.
Pur. Agt., J. W. Casterton
Traf. Mgr., A. G. Phelps
Refineries located at Bayonne, Linden, Jersey City, Baltimore, Parkersburg, Charleston

Standard Oil Co. of Ohio, Sixteenth Floor, Midland Bldg., Cleveland, Ohio
Pres., W. T. Holliday
V. P.'s, A. M. Maxwell, A. A. Stambaugh, H. F. Spears, W. J. Semple, L. S. Bale
Sec., F. H. Kelly
Treas., W. J. Semple
Mgr. Ref., L. S. Bale
Supts., A. H. Buchanan, No. 1 Works, Cleveland; L. B. Helm, No. 2 Works, Cleveland; G. W. Hanneken, Toledo; E. A. Brown, Latonia, Ky.; J. R. Cuthbert, Lima, Ohio
Tank Car S. M., A. B. Nichols
Bulk S. M., A. C. Dutton
Station S. M., C. T. Foster
Pur. Agt., S. H. Elliott
Traf. Mgr., W. A. Wareing
Refineries—No. 1 Works, Cleveland, Ohio; No. 2 Works, Cleveland, Ohio; Toledo, Ohio; Latonia, Ky.; Solar Refinery, Lima, Ohio

Stanolind Oil & Gas Co., Philcade Bldg., Tulsa, Okla.
Pres., F. O. Prior
V. P.s, A. M. McCorkle, E. F. Bullard
Sec. and Treas., F. J. Keleher
Gen. Supt., P. G. Weidner
Supt., O. W. White, Superior, La.
Tank Car S. M., F. J. Keleher
Ch. Prod. Egr., M. C. Hoffman
Pur. Agt., W. L. James
Traf. Mgr., F. J. Keleher
Refinery located at Superior, La.

Starlight Refinery Co., Karns City, Pa.
Pres., F. J. Pickard
V. P., W. B. Purvis
Sec., Howard I. Painter
Treas. and Gen. Supt., Clyde E. Pickard
Gen. Mgr., F. J. Pickard
Refinery located at Karns City, Pa.

Star Refinery, Osage, Wyo.
Gen Mgr., Gretchen G. Ross
Refinery located at Osage, Wyo.

Star Refining & Producing Co., Fort Worth, Tex.
Pres., W. M. Harrison
V. P., Herman Gartner
Sec. and Treas., Clara Mabry
Gen. Mgr., W. M. Harrison
Gen. Supt., Joe King
Tank Car and Station S. M., H. Atherton
Pur. Agt., W. M. Harrison
Traf. Mgr., H. Atherton
Refinery located at Fort Worth, Tex.

Stoll Oil Refining Co., Inc., 227 W. Main, Louisville, Ky.
Pres., C. C. Stoll
V. P. Chg. Sales, Geo. Stoll
V. P. Chg. Ref., Berry V. Stoll
V. P. Chg. Stations and Branches, Chas. E. Stoll
Sec. and Treas., Wm. A. Stoll
Supt., J. W. Kittner
Asst. Supt., Covington Arteburn
Tank Car S. M., J. J. Kirchner
Station S. M., C. E. Stoll
Ch. Chem., Clem S. Luce
Pur. Agt., John D. Crowdus
Traf. Mgr., Geo. E. Gill
Refinery located at Louisville, Ky.

Sterling Refining Co., Box 114-A, Bell, Calif.
Gen. Mgr., Gould M. Fitch
Refinery located at Bandini, Calif.

Stone Oil Co., Second National Bank Bldg., Houston, Tex.
Pres., R. W. Stone
V. P., H. M. Stone
Sec. and Treas., Adelaide La Combe
Gen. Supt., H. M. Stone
Refinery located at Texas City, Tex.

Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Pres., J. Howard Pew
V. P.s, J. N. Pew, Jr., J. Edgard Pew, S. B. Eckert, A. E. Pew, Jr.
Sec. and Treas., Frank H. Cross
Supts., W. D. Mason, Marcus Hook, Pa.; H. O. Cameron, Toledo, Ohio; C. B. Carter, Yale, Okla.
V. P. Chg. Sales, S. S. Eckert
Ch. Chem., Dr. Gellert Alleman
Pur. Agt., W. H. Booth
Refineries located at Marcus Hook, Pa., Toledo, Ohio, and Yale, Okla.

Sunray Oil Co., Philtower Bldg., Tulsa, Okla.
Pres., C. H. Wright
V. P., F. L. Martin
Sec., W. D. Forster
Treas. L. W. Bennett
Gen. Supt., F. L. Martin
Supt., R. L. Johnson, Allen, Okla.
Asst. Supt., A. D. Vinson
Tank Car S. M., F. L. Martin
Ch. Chem., J. B. Fairfield
Ch. Egr., R. L. Johnson
Pur. Agt., R. E. Campbell
Traf. Mgr., J. B. Fairfield
Refinery located at Allen, Okla.

Super Asphalt Products Co., Long Beach, Calif.
Pres. and Gen. Mgr., W. H. Geis
Refinery located at Long Beach, Calif.

Superior Oil Works, 8 Hammond Road, Warren, Pa.
Pres., R. Z. Morrison
V. P., F. C. Eaton
Sec. and Treas., H. G. Eaton
Gen. Mgr., H. G. Eaton
Supt., H. S. Peterson
Asst. Supt., R. B. Allmendinger
Tank Car S. M., H. G. Eaton
Ch. Chem., R. B. Allmendinger
Pur. Agt., H. F. Cogswell
Traf. Mgr., C. H. Eaton
Refinery located at Warren, Pa.

Supreme Refining Co., Gladewater, Tex.
Owner, Nathan Lynch
Refinery located at Gladewater, Tex.

T

Taxman Refining Co., Inc., Box 119, Wichita Falls, Tex.
Pres., J. J. Taxman
V. P., Maynard Taxman
Sec. and Treas., M. Taxman
Gen. Mgr., J. J. Taxman
Gen. Supt., J. C. Hinds
Tank Car S. M., Maynard Taxman
Station S. M., E. S. Taxman
Pur. Agt. and Traf. Mgr., C. W. Hulland
Auditor, G. L. Jones
Refinery located at Wichita Falls, Tex.

Taylor Refining Co., Taylor, Tex.
Pres., G. L. Rowsey
V. P., Ben H. Harrison
Sec., Harris A. Melaskey
Treas., Ben H. Harrison
Gen. Mgr., G. L. Rowsey
Supts., J. B. Mayo, Taylor, Tex.
Tank Car S. M., G. L. Rowsey
Pur. Agt., Ben H. Harrison
Refinery located at Taylor, Tex.

Texanna Refining Co., Kilgore, Tex.
Owner, E. F. Eberhart.
Refinery located at Kilgore, Tex.

Texas Co., The (California), 929 South Broadway, Los Angeles, Calif.
Pres. and Gen. Mgr., C. E. Olmsted, Los Angeles
V. P.s, J. A. Bermingham, Los Angeles; R. T. Herndon, Los Angeles; L. R. Holmes, Los Angeles; H. W. Dodge, New York.
Sec., E. M. Crone, New York
Treas., C. E. Woodbridge, New York
Mgr. Ref., L. R. Holmes, Los Angeles
Supts., W. J. Ryan, Los Angeles; J. R. Scanlin, Fillmore, Calif.
Mgr. Sales Dept., R. T. Herndon, Los Angeles
Pur. Agt., A. F. Colling, New York
Refineries located at Los Angeles, Calif.; Fillmore, Calif., and Coalinga, Calif. (Last shut down.)

Texas Co., The (Delaware), 135 East Forty-second St., New York City
Pres., W. S. S. Rodgers
V. P.s, T. J. Donoghue, Houston, F. T. Manley, New York; G. L. Noble, Houston; R. Ogarrio, New York; T. Rieber, New York; H. W. Dodge, H. T. Klein, New York
Sec., E. M. Crone, New York
Treas., C. E. Woodbridge, New York
Mgr. Ref. Dept., F. T. Manley, New York
Supts., F. P. Dodge, Gen. Supt., Port Arthur, Tex.; F. S. Dengler, Port Neches, Tex.; T. J. Landry, Houston; R. G. Collins, West Dallas; W. K. Holmes, West Tulsa; C. B. Bogart, Lockport, Ill.; R. H. Donaldson, Shreveport; J. R. Reed, Pryse, Ky.; A. E. Higgs, San Antonio; S. W. Darling, Amarillo; H. A. Fouts, El Paso, Tex.; L. F. Wilking, Casper, Wyo.; T. J. Davidson, Calpet, Wyo.; G. O. Shefstead, Craig, Colo.; L. F. J. Wilking, Cody, Wyo.; O. M. Webb, Sunburst, Mont.; L. Lee, Norfolk, Va.; C. G. Cramer, Marcus Hook, Pa.; V. B. Peveto, Providence, R. I.
Domestic Sales Dept., H. W. Dodge, Gen. S. M., New York; R. L. Saunders, Mgr., Northern Territory, New York; J. S. Leach, Mgr., Southern Territory, Houston; S. B. Wright, Mgr., Central Territory, Chicago.
Foreign Sales Dept., T. Rieber, V. P. and Mgr., New York
Pur. Agt., A. F. Colling, New York
Refineries located at Port Arthur, Tex.; Port Neches, Tex.; Houston, Tex.; West Dallas, Tex.; West Tulsa, Okla.; Lockport, Ill.; Shreveport, La.; Pryse, Ky.; San Antonio, Tex.; Amarillo, Tex.; El Paso, Tex.; Casper, Wyo.; Calpet, Wyo.; Cody, Wyo.; Sunburst, Mont.; Norfolk, Va.; Marcus Hook, Pa.; Providence, R. I. (Calpet, Wyo., plant operates as California Petroleum Corp. of Utah; Sunburst, Mont., plant operates as International Refining Co.)

Texas-Mexican Oil & Refining Co., Laredo, Tex.
Pres., M. T. Cogley
V. P., C. Edw. Cole
Sec. and Treas., Ralph Berry
Gen. Mgr., C. Edw. Cole
Refinery located at Laredo, Tex.

Texas Oil Products Co., Box 775, Gladewater, Tex.
Pres., C. R. Starnes
V. P., Glenn J. Smith
Sec. and Treas., E. L. Ames
Gen. Mgr., C. R. Starnes
Gen. Supt., F. N. Williams
Asst. Supt., W. F. Thomas
Tank Car S. M., W. C. McCallion
Ch. Chem., H. L. Kerr
Pur. Agt., E. L. Ames
Traf. Mgr., W. C. McCallion
Refinery located at Gladewater, Tex.

Texas Pacific Coal & Oil Co., Fort Worth National Bank Bldg., Fort Worth, Tex.
Pres., J. R. Penn
V. P.s, John Hancock, R. J. Fleckenstein
V. P. Chg. Ref., E. R. Lederer
V. P. Chg. Sales, O. E. Mitchell
Sec. and Treas., R. Seibel
Supt., G. M. Pfau, Fort Worth, Tex.
Asst. Supt., C. E. Boyd
Tank Car S. M., F. D. Bostaph
Station S. M., Roy M. Naugle
Ch. Egr., D. J. Costa
Ch. Chem., E. W. Zublin
Pur. Agt., Harris Pruitt
Traf. Mgr., E. A. Starr
Refineries located at Wynnewood, Okla.; Fort Worth, Tex., and Caddo, Tex.

Texas Petroleum Products Co., Somerset, Tex.
Pres., Grover C. Shaw
V. P., F. H. Witherspoon
Sec. and Treas., W. I. Lighthouse
Supt., G. B. Dartois
Refinery at Somerset, Tex.

Tide Water Oil Co., 17 Battery Place, New York, N. Y.
Pres., Edward L. Shea
V. P.s, Robert McKelvy, Noel Robinson, Edward H. Salrin
Sec., William J. Burlser
Treas., K. R. Hankinson
Gen. Mgr. Ref., C. R. Barton
Supt., H. S. Chase, Bayonne
Tank Car S. M., L. C. Quackenbush
Station S. M., J. D. Collins
Ch. Egr., E. Ellsberg
Ch. Chem., J. McCoy
Pur. Agt., P. W. Fenton
Traf. Mgr., C. F. Dowd
Refinery located at Bayonne, N. J.

Tide Water Oil Co. (Oklahoma), Box 731, Tulsa, Okla.
Pres., E. L. Shea
V. P.s, C. R. Barton, E. H. Salrin, R. B. Pringle, J. W. Warner, J. R. Gahan
Sec., Y. P. Broome
Treas., K. R. Hankinson
Supt., R. S. Stanfield, Drumright, Okla.
Asst. Supt., L. M. Jagou, Drumright
Tank Car and Station S. M., J. W. Warner
Ch. Egr., O. A. Gierow
Ch. Chem., R. W. Boyd
Pur. Agt., M. F. Bridges
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Sec., G. P. McDonald
Treas., M. F. Braeckel
Gen. Supt., H. W. Walchli
Sales Mgr. and Pur. Agt., H. W. Walchli
Ch. Chem., C. R. Johnson
Traf. Mgr., W. E. Miller
Refinery located at Clarendon, Pa.

Toole County Refining Co., Oilmont, Mont.
Pres., G. C. Hoyt
Sec. and Treas., J. A. Coons
Refinery located at Oilmont, Mont.

Triangle Oil & Refining Co., 563 Washington Blvd., Venice, Calif.
Pres., G. A. Lathrop
V. P., L. W. Frankley
Sec. and Treas., C. W. Allison
Gen. Mgr., C. W. Allison
Gen. Supt., L. R. Taylor
Station S. M., F. H. Boston
Pur. Agt., H. S. Capron
Refinery located at Venice, Calif.

Trinity Refining Co., P.O. Box 146, Fort Worth, Tex.
Pres., R. B. Farris
V. P.s, Dr. C. D. Halley, R. A. Stuart
Sec., F. L. Mitchell
Gen. Mgr., R. B. Farris
Gen. Supt., W. M. Paull
Prod. Supt., W. F. Hurst
Tank Car S. M., P. L. Jennings
Traf. Mgr., John E. Haynes
Refinery located at Gladewater, Tex.

Trio Refining Co., Arp, Tex.
Owner, M. J. Grogan
Refinery located at Arp, Tex.

Tri-State Refining Co., Ashland, Ky.
Pres., Paul G. Blazer
V. P., E. F. Wells
Sec., E. L. McDonald
Treas., E. W. Seaton
Gen. Mgr., Paul G. Blazer
Gen. Supt., F. W. Irwin
Tank Car S. M., E. F. Wells
Station S. M., A. A. Hines
Ch. Engr., C. C. Compton
Pur. Agt., M. K. Lovell
Ch. Chem., C. O. Garbrecht
Traf. Mgr., P. H. Banks
Refinery located at Kenova, W. Va.

Troy Refining Corp., Troy, Ind.
Pres., Auburn Stinson
V. P., C. D. Schreiber
Sec. and Treas., Dewey Stinson
Gen. Mgr., Dewey Stinson
Gen. Supt., M. R. Rippy
Station S. M., W. T. Anderson
Ch. Chem., M. R. Rippy
Refinery located at Troy, Ind.

Tucker Oil Co., Wichita Falls, Tex.
Pres., J. J. Perkins
V. P., Charles J. Tucker
Sec. and Treas., Harold Murph
Gen. Mgr., Charles J. Tucker
Gen. Supt., Charles J. Tucker
Supt., L. B. Horr, Box 212, Thrift, Tex.
Sales Mgr. (bulk), Charles J. Tucker
Ch. Chem., J. Dickson, Box 245, Burkburnett, Tex.
Pur. Agt., L. B. Horr
Refinery located at Burkburnett, Tex.

Tyler Texas Oil & Refining Co., Tyler, Tex.
Pres., P. J. McMurray
V. P., Marvin McMurray
Sec.-Treas., A. D. Blackwell
Refinery located at Tyler, Tex.

Tyreco Refining Co., Overton, Tex.
Owners, Dick Duncan, Errol C. Holt
Refineries located at Arp and Overton, Tex.

Tyro Refining Co., Tyro, Kans.
Pres., Gladys Muller
V. P., Treva Mason
Sec., O. C. Crossland
Treas., Lela Kasster
Supt., O. C. Crossland
Ch. Chem., Walter Murray
Traf. Mgr., O. C. Crossland
Refinery located at Tyro, Kans.

U

Ultra-Penn Refining Co., Bruin, Pa.
Pres., H. C. Eaton
V. P., H. H. Phillips
Sec. and Treas., F. C. Dodds
Gen. Mgr., H. C. Eaton
Gen. Supt., W. G. Wagner
Asst. Supt., C. J. McCorry
Tank Car S. M., S. L. Gehr
Ch. Chem., W. R. Storey
Traf. Mgr., J. A. Hall
Refinery located at Bruin, Pa.

Union Oil Co. of California, 617 West Seventh St., Los Angeles, Calif.
Pres., L. P. St. Clair
Exec. V. P., R. D. Matthews
V. P.s, W. W. Orcutt, W. L. Stewart, Jr., Paul M. Gregg
Asst. V. P., A. C. Galbraith
Sec., W. R. Edwards
Asst. Secs., E. H. Estill, A. W. Milford
Comptroller, G. H. Forster
Asst. Compts., A. H. Hand, M. G. Kerr, A. B. Mason
Treas., J. M. Rust
Asst. Treas., A. C. Marshall, E. H. Estill
Director of Mfg., R. E. Haylett
Mgr. Ref., L. G. Metcalf
Supts., A. Roy Heise, Oleum; R. W. Frazier, Avila; H. Ambrosier, Maltha (Bakersfield); C. W. Burtless, Santa Paula; John Salmond, Wilmington (Los Angeles)
Dir. of Sales, V. H. Kelly
Mfg. Ref. Oil Sales, J. M. Geary
Devel. Engr., Earle W. Gard
Mgr. Research, Dr. D. R. Merrill
Mgr. Purchases, H. C. Farquhar
Dir. Trans., William Groundwater
Refineries located at Oleum, Avila, Maltha (Bakersfield), Santa Paula, Wilmington (Los Angeles), Calif.

Union Refining Co., Camp Switch, Tex.
Pres., H. J. Strief
V. P., Roy Davis
Sec., C. M. Zinc
Refinery located at Camp Switch, Tex.

United Refining Co., 124 Dobson Ave., Warren, Pa.
Pres., F. G. Bannerot
V. P., H. A. Logan
Sec., H. W. Schmidt
Treas. and Gen. Mgr., H. A. Logan
Asst. Supt., John S. Cameron
Tank Car S. M., H. A. Logan and H. W. Schmidt
Prod. Engr., MacLean Houston
Ch. Chem., Herbert Wagner
Traf. Mgr., Ralph E. Brasington
Refinery located at Warren, Pa.

Unity Petroleum Corp., P. O. Box 391, Shelby, Mont.
Pres., Boris A. S. Aronow
Gen. Mgr., Boris A. S. Aronow
Supts., Ed Styren, Kalispell, Mont.; Roy Sticka, Havre, Mont.
Sales Mgr. and Pur. Agt., Boris A. S. Aronow
Refineries located at Kalispell, Mont., and Havre, Mont.

Upshur Refining Co., Inc., Box 676, Gladewater, Tex.
Pres., F. R. Jackson
V. P., Mrs. P. B. Goodwin
Sec., H. Melton
Treas., P. W. Leland
Gen. Mgr., F. R. Jackson
Sales Mgr., H. Melton
Pur. Agt., C. F. Linsey
Ch. Chem., J. L. Jones
Refinery located at Gladewater, Tex.

Utah Oil Refining Co., Seventh Floor, Newhouse Bldg., Salt Lake City, Utah. Subsidiary of Standard Oil Co. (Indiana)
Pres., T. A. Dines
V. P.s, William R. Wallace, A. N. Johnson, M. J. Greenwood, E. S. Holt
Sec. and Treas., A. N. Johnson
Supt., E. S. Holt
Asst. Supt., Frank R. Clark
Tank Car S. M., M. J. Greenwood
Bulk Station S. M., A. S. Brown
Serv. Station S. M., M. H. Sutton
Ch. Egr., R. G. Clark
Ch. Chem., Gordon I. Kirby
Pur. Agt. and Traf. Mgr., W. H. Lovesy
Refinery located at Salt Lake City, Utah

Utah Refining Co., Kilgore, Tex.
Owners, J. C. Potter, Julian Potter
Refinery located at Kilgore, Tex.

V

Valley Refining Co., P. O. Box 11, Harlingen, Tex.
Partnership, A. B. White and L. O. Blocker
Gen. Mgr., A. B. White
Supt. and Ch. Chem., C. R. McGinnis
Asst. Supt., Eddie Day
Sales Mgr. and Pur. Agt., A. B. White
Refinery located at Harlingen, Tex.

Valley Refining Co., East College Blvd., Roswell, N. Mex.
Pres., S. W. Lodewick
V. P., H. C. Buchly
Sec. and Treas., S. P. Johnson, Jr.
Gen. Mgr., S. W. Lodewick
Gen. Supt., E. A. Wahline
Refinery located at Roswell, N. Mex.

Valvoline Oil Co., Fifth and Butler Sts., Cincinnati, Ohio.
Pres., H. W. Edwards
V. P. and Gen. Mgr., C. J. Leroux
V. P.s, H. M. Hart, C. C. Gould, C. W. Luton, J. H. Garlough, V. L. Abbey
Sec., C. C. Gould
Treas., C. J. Leroux
Gen. Supt., C. W. Luton
Supts., Arthur Hagen, Butler, Pa.; Henry Winkler, Franklin, Pa.
Tank Car S. M., Harold Dunmire
Station S. M., W. Wasterson and C. E. McBurney
Ch. Engr., Louis Calkins
Ch. Chem., Mr. Smith
Pur. Agt., E. H. Shepherd, Cincinnati, Ohio, and K. Wychoff, New York, N. Y.
Traf. Mgr., E. A. Barror, Butler, Pa.
Refineries located at Butler and Franklin, Pa.

Vickers Petroleum Co. of Delaware, Wheeler-Kelly-Hagny Bldg., Wichita, Kans.
Pres., J. A. Vickers
V. P., C. L. Henderson
Sec. and Treas., J. S. Wertz
Gen. Mgr., C. L. Henderson
Supt., A. M. Schrepfer, Potwin, Kans.

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Tank Car S. M., Myers Gross
Ch. Chem., A. M. Schrepfer
Pur. Agt. and Traf. Mgr., H. G. Shaw
Refinery located at Potwin, Kans.

W

Wabash Refining Co., Gladewater, Tex.
Owners, R. W. Porter, W. L. Porter
Refinery located at Gladewater, Tex.

Wadhams Oil Co., 907 First St., Milwaukee, Wis. (Subsidiary of Socony-Vacuum Corp.)
Chm., Bd., A. G. Maguire
Pres., H. W. Dodge
V. P.s, Henry J. Stolz, Louis McNally, J. M. McLaughlin, M. G. Peeters
Sec., R. P. Schwalbach
Treas., R. W. Fritzke, Jr.
Gen. Mgr., Henry J. Stolz
Gen. Supt., Wm. Hildebrandt, E. Chicago, Ind.
Ch. Chem., J. A. Hart, East Chicago, Ind.
Pur. Agt., H. A. Steffen, Milwaukee, Wis.
Refinery located at East Chicago, Ind.

Waggoner Refining Co., Inc., Box 107, Electra, Tex.
Pres., G. L. Waggoner
V. P., E. P. Waggoner
Sec. and Treas., R. L. More
Mgr., D. G. Gray
Supt., J. B. Joyce
Asst. Supt., H. A. Mitchell
Tank Car S. M., H. D. Jenkins
Station S. M., R. F. Schmann
Ch. Engr., J. B. Joyce
Ch. Chem., G. A. Birdsall
Pur. Agt., J. T. McNamara
Traf. Mgr., O. L. Ely
Refinery located at Electra, Tex.

Walter Steiner Refining Co., 2132 South St., Long Beach, Calif.
Pres., Walter Steiner
V. P., Curtis Flint
Sec. and Treas., Adelaide Steiner
Salesman, Curtis Flint
Refinery located at Long Beach, Calif.

Warner-Quinlan Co., 2 Park Ave., New York City
Pres., L. V. Nicholas
V. P., W. W. McFarland
Sec., E. W. Korsmeyer
Treas., A. M. Talbott
Asphalt Dept., F. D. Kessler
Supt., I. K. Giles, Warners, N. J.
Asst. Supt., A. R. Blakey, Linden, N. J.
Tank Car S. M., E. M. Grossman
Station S. M.s, P. S. Wood and T. E. Gavin
Ch. Engr., R. R. Gove
Ch. Chem., J. A. Lunn
Pur. Agt., A. L. McMillan
Traf. Mgr., Henry Reigler
Refinery located at Linden, N. J.

Warr-Penn Refining Co., Warren, Pa.
Pres., E. W. Campbell
V. P., L. B. Schofield
Sec., E. N. Jacobson
Treas. and Gen. Mgr., George W. Campbell
Gen. Supt., C. Peterson
Asst. Supt., G. Peck
Tank Car S. M., George W. Campbell
Ch. Chem., F. Alginger
Pur. Agt., George W. Campbell
Traf. Mgr., L. B. Gordon
Refinery located at Warren, Pa.

Wasatch Oil Refining Co., 815 McIntyre Bldg., Salt Lake City, Utah
Pres., Wm. H. McIntyre
V. P., Henry D. Moyle
Sec., T. T. Little
Treas., Wm. Yeates
Supt., C. B. Owen
Asst. Supt., Glen Kennick
Refinery located at Woods Cross, Utah

Waverly Oil Works Co., Fifty-fourth St. and A.V.R.R., Pittsburgh, Pa.
Pres., S. M. Vockel
V. P.s, F. W. Wappat, G. E. Willey, W. H. Millhiser
Sec., W. E. Allison
Treas., S. K. Cunningham
Gen. Mgr., W. H. Millhiser
Gen. Supt., W. H. Millhiser
Gen. Sales Mgr., J. F. King
Ch. Chem., W. T. Sieber
Pur. Agt., W. H. Millhiser
Traf. Mgr., S. Fox
Refineries located at Pittsburgh, Pa.

Wayco Refining Co., 409 Griswold St., Detroit, Mich.
Pres., John N. Stalker
V. P. and Gen. Mgr., Andrew G. Schlee
Sec. and Treas., Harry Eberline
Supt., J. J. Curren, Toledo, Ohio
Tank Car and Station S. M., Edward F. Schlee
Ch. Engr., Fred Schaeffer
Ch. Chem., Marvin J. Galvin
Pur. Agt., Andrew G. Schlee
Refinery located at Toledo, Ohio

Western Oil & Refining Co., 416 West Eighth St., Los Angeles, Calif.
Pres., Richard Florian
V.P.s, A. W. Taylor, R. R. Rakestraw
Sec. and Treas., A. A. G. Scherbel
Asst. Sec. and Treas., L. J. Hart
Gen. Mgr., Frank E. Lee, Agent for Robert C. Gillis, Receiver
Gen. Supt., R. R. Rakestraw
Supt., O. C. Smith
Asst. Supt., H. H. Spangler
Tank Car and Station S. M., A. W. Taylor
Ch. Engr., E. J. McKee
Ch. Chem., H. H. Spangler
Pur. Agt., J. S. Baum
Refinery located at Wilmington, Calif.

West Texas Refining Co., 1405 Tower Petroleum Bldg., Dallas, Tex.
Pres., F. W. Burford
V. P., John J. Thomas
Sec., John R. Scott
Treas., E. V. Campbell
Gen. Mgr., John J. Thomas
Tank Car S. M., Ralph E. Bishop
Station S. M., J. B. Cashell
Pur. Agt., W. M. Bisett
Traf. Mgr., A. L. Heine
Refinery located at Pecos, Tex.

Wheatland Refining Co., Wheatland, Wyo.
Sole owner, B. R. Brown

White Star Oil & Refining Co., 2400 Artesia Blvd., North Long Beach, Calif.
Pres. and Gen. Mgr., D. R. Wilson
Refinery located at Long Beach.

Wickett Refining Co., Wickett, Tex.
Pres., W. B. Hassett
V. P., George W. Buckner
Treas., George W. Buckner
Gen. Supt., J. T. Miller
Tank Car S. M., J. B. Saunders, Clayton, Mo.
Refinery located at Wickett, Tex.

Wilcox, H. F., Oil & Gas Co., Sixth and Denver St., Tulsa, Okla.
Pres., Homer F. Wilcox
V. P. and Gen. Mgr., G. A. Dye
V. P. and Treas., M. P. Appleby
V. P. Chg. Ref., F. H. Dunn
Sec., L. J. Yarbrough
Supts., W. M. Fraser, Bristow, Okla.; John A. Oakes, Pampa, Tex.
Tank Car S. M., T. H. Riggin
Station S. M., L. G. Murrell
Ch. Chem., James Hodge
Pur. Agt., H. B. Ward
Traf. Mgr., T. H. Riggin
Refineries located at Bristow, Okla.

Williamson, Chas. A., 574 North Gower St., Los Angeles, Calif.
Owner, Chas. A. Williamson.
Refinery located at Long Beach, Calif.

Williams Refining Co., P. O. Box 1364, Shreveport, La.
Gen. Mgr., W. T. Williams
Refinery located at Shreveport, La.

Wilshire Oil Co., 2455 East Twenty-seventh St., Los Angeles, Calif.
Pres., George R. Machris
V. P. and Sec., Alfred P. Machris
Refineries located at Vernon (Los Angeles) and Bandini, Calif. (latter under construction)

Wolfe Refining Co., Kilgore, Tex.
Owner, R. L. Wolfe
Refinery located at Kilgore, Texas.

Wolverine-Empire Refining Co., 51 Madison Ave., New York City and Oil City, Pa.
Chm. Bd. and Gen. Mgr., E. W. Chase, Oil City, Pa.
Pres., C. H. Ellingwood, New York
V. P. and Sec., A. W. Scott, Oil City
Treas., F. W. Baer, New York
Gen. Supt., A. W. Cole, Reno, Pa.
Supt., M. F. Spencer, Tidioute, Pa.
Tank Car S. M., A. W. Scott
Station S. M., O. P. Keeney
Ch. Chem., W. B. Smith, L. M. Baltzell, Asst.
Pur. Agt., W. J. Scott
Traf. Mgr., L. R. Cavanaugh
Refineries located at Reno, Pa., and Tidioute, Pa.

Wyoil Refining Co., Con.-Roy Bldg., Casper, Wyo.
Pres., George W. Jarvis
V. P.s, H. B. Durham, Chas Ansa
Sec. and Treas., J. T. Scott
Gen. Supt., Paul Lowrey
Refinery located at Mills (suburb of Casper), Wyo.

Wyoming Gas & Oil Co., Osage, Wyo.
Gen. Mgr., C. F. Martens
Supt., Mike Materi
Refinery located at Osage, Wyo.

Y

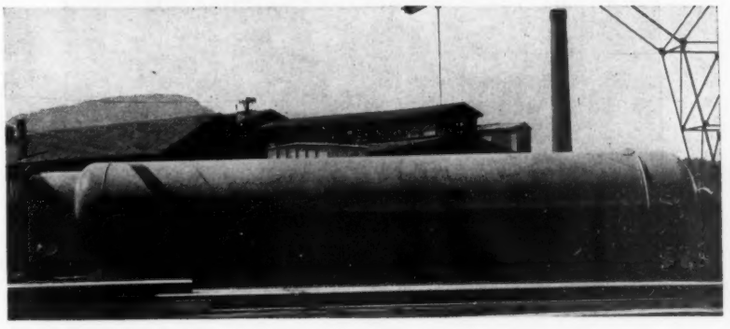
Yale Oil Corp., Yale, Okla.
Pres., L. B. Hancock
V. P., Bob Hancock
Sec. and Treas., F. B. Hancock
Gen. Supt., W. Shaw
Tank Car S. M., F. B. Hancock
Traf. Mgr., C. R. Ramsey
Refinery located at Yale, Okla.

Yale Oil Corp. of South Dakota, Billings, Mont.
Pres., L. B. Hancock
V. P., P. N. Fortin, Billings
Supt., D. D. Gibson, Billings
Sales Supervisors, L. P. Barney, H. L. Hitchcock
Ch. Engr. and Chem., T. R. Corbett
Refineries located at Billings and Miles City, Mont.

Yuba Oil Co., Nacogdoches, Tex.
Pres., Geo. E. Ginter
V. P., J. B. Morton
Sec. and Treas., M. L. Ginter
Gen. Mgr., Geo. E. Ginter
Gen. Supt., I. D. Power
Ch. Chem., W. W. Grim

PRESSURE VESSELS

Fabricated to Your Order



Of Carbon, Alloy or Clad Steel —Welded or Riveted

The butane gas storage tank shown above—one of a shipment of five such tanks—is a fair example of the wide range of our work in fabricating pressure vessels. Dimensions are 48 ft., 7 in., overall length, by 8 ft., 0 in. inside diameter. Design pressure, 165 lb. per sq. in.

In our Hedges-Walsh-Weidner Company shops, at Chattanooga, where these tanks were constructed, pressure vessels have been built for more than fifty years. To this half century of experience are added facilities of every kind . . . boiler shops, welding shops, foundry, pattern shops, machine shops; plate bending press capable of shaping plates cold up to four inches thick; Class 1 welders; furnace for stress relieving; 300,000-volt X-ray machine; chemical and physical laboratory.

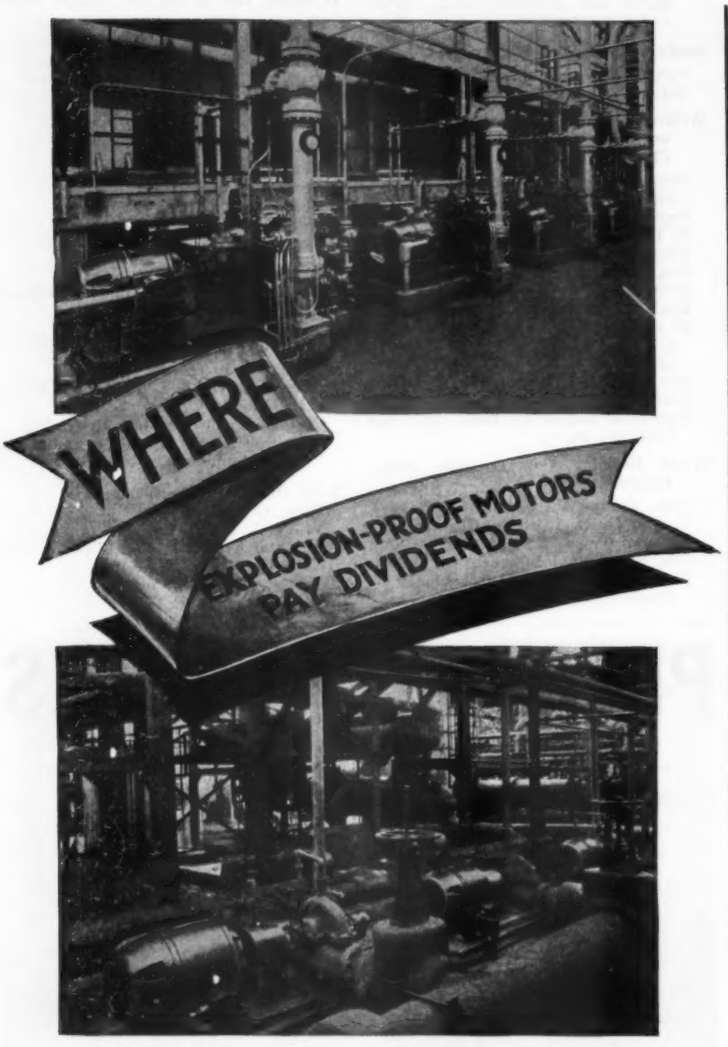
Vessels may be any dimensions up to shipping clearance limits. Welded or riveted. Fabricated to order.

COMBUSTION ENGINEERING COMPANY, Inc.

200 MADISON AVENUE, NEW YORK, N. Y.

CANADIAN ASSOCIATES, COMBUSTION ENGINEERING CORPORATION, Ltd., MONTREAL

A-177a



TOP—G-E explosion-proof motors direct-connected to pumps in outdoor refinery

BOTTOM—Modern oil refinery, showing G-E explosion-proof motors in solvent plant

YOU can save money and obtain safer, more dependable service by standardizing G-E explosion-proof motors built for Class I, Group D, hazardous gas locations.

Since the early pioneering of the explosion-proof motor by General Electric, much has been done to improve the design, both electrically and mechanically. There are now explosion-proof motors, in ratings up to 250 hp., for every application where this type of apparatus is required. With control to match, you can now obtain "tailor-made" motors and control for every requirement.

When you buy G-E explosion-proof motors and control, you obtain the benefit of years of experience in the design, manufacture, and application of explosion-proof equipment. Consult our refinery specialist in the nearest G-E office for assistance in the selection of proper drives for your plant. General Electric, Schenectady, N. Y.

011-60

GENERAL ELECTRIC

Personnel Refineries in Canada

B

Bell Refining Co., Ltd., 1202 First St., West, Calgary, Alberta, Canada
Pres., A. G. Spooner
V. P., R. A. Brown
Sec. and Treas., T. W. McKee
Gen. Mgr., F. J. Huff
Gen. Supt., Maurice Stevens
Tank Car and Station S. M., C. A. Scott
Ch. Chem., H. A. Taylor
Pur. Agt., T. W. McKee
Refinery located at Calgary, Alberta

British-American Oil Co., Ltd., Royal Bank Bldg., King and Young Sts., Toronto, Canada
Pres., A. L. Ellsworth
V. P., C. L. Suhr
Treas., J. C. Millar
Sec. and Sales Mgr., P. W. Binns
Mgr., Ref., L. E. Woolley
Supts., R. L. Rude, Toronto; D. W. Monroe, Montreal; E. R. Cook, Moose-Jaw, Sask.; M. Beringer Coutts, Alberta
Asst. Supts., W. Gault, Toronto; H. E. Saunders, Montreal
Ch. Engr., J. C. Ellis
Ch. Chem., R. Campbell
Pur. Agt., J. E. Joyce
Traf. Mgr., R. Winfield
Refineries located at Moose Jaw, Saskatchewan; Coutts, Alberta; Toronto, Ontario, and Montreal, East Quebec

C

Canadian Oil Companies, Ltd., 12 Strachan Ave., Toronto, Ontario, Canada
Pres., F. B. Fretter
V. P., F. H. Littliefield
Sec., H. F. Hoecker
Treas., F. C. West
Gen. Mgr., F. H. Littliefield
Gen. Supt., C. A. Hale
Tank Car S. M., F. C. West
Ch. Chem., E. A. Smith
Pur. Agt., G. S. Middaugh
Traf. Mgr., C. E. Wilfong
Refinery located at Petrolia, Ontario

E

Excel Refineries, Ltd., Weyburn, Saskatchewan, Canada
Pres., E. Wisland
Sec. and Treas., O. W. Harvey
Refinery located at River Side Park Subdivision, Weyburn, Saskatchewan

H

Hi-Way Oil Co., Ltd., P.O. Box 291, New Westminster, British Columbia, Canada
Gen. Mgr., Bertram W. Webster
Gen. Supt., Edward Neil
Acct. and Credit Mgr., Norman H. Wallace
Refinery located at South Westminster, British Columbia

Home Oil Distributors, Ltd., 555 Burrard St., Vancouver, British Columbia, Canada
V. P., Austin C. Taylor
Sec. and Treas., W. W. Boultbee
Gen. Mgr., H. G. Fowler
Gen. Supt., Duncan Fraser
Tank Car S. M., L. J. Martin
Station S. M., C. Shepherd
Ch. Chem., A. F. Rees
Pur. Agt. and Traf. Mgr., S. F. Barbour
Comptroller, H. W. Hamilton
Refinery located at North Vancouver, British Columbia

I

Imperial Oil, Ltd., 56 Church St., Toronto, Ontario, Canada
Pres., G. H. Smith
V. P.s, Victor Ross, C. A. Eames, R. V. LeSueur
Dirs., G. H. Smith, Victor Ross, C. A. Eames, R. V. LeSueur, L. C. McCloskey, J. McNeil
Sec. and Treas., F. E. Holbrook, Sarnia, Ontario
Dir. Mfg., L. C. McCloskey
Gen. Supt., Charles Leaver
Supts., A. D. Grant, Ioco, British Columbia; C. M. Moore, Calgary, Alberta; C. E. Carson, Regina, Saskatchewan; G. L. Stewart, Sarnia, Ontario; F. C. Mechin, Montreal, Quebec; R. L. Dunsmore, Dartmouth, Nova Scotia.
Asst. Supts., E. E. Dauphinee, Ioco, British Columbia; J. J. Hanna, Calgary, Alberta; C. R. Moore, Regina, Saskatchewan; J. J. McCarthy, Montreal, Quebec; R. D. King, Dartmouth, Nova Scotia
Dir. of Sales, J. McNeil
Ch. Engr., T. Montgomery, Sarnia, Ontario
Ch. Chem., Gordon McIntyre, Sarnia, Ontario
Ch. Research Chem., Dr. R. K. Stratford, Sarnia, Ontario
Pur. Agt., L. E. Bury, Toronto, Ontario
Traf. Mgr., W. H. Dickie
Refineries located at Ioco, British Columbia; Calgary, Alberta; Regina, Saskatchewan; Sarnia, Ontario; Montreal, Quebec, and Dartmouth, Nova Scotia

M

McColl-Frontenac Oil Co., Ltd., Royal Bank Bldg., Montreal, Quebec, Canada
Pres., John Irwin
V. P.s, P. A. Thomson, J. A. Wales, J. M. Pritchard, S. S. Griffiths, H. H. Bradburn, Col. W. A. Bishop, V. C.
Sec. and Treas., Fred Hunt
Comptroller, L. A. Brooks
V. P. in chg. Operations, J. A. Wales
Supts., J. D. Brown, Montreal East, Quebec; C. B. W. Anderson, Toronto, Ontario
Asst. Supts., L. W. McClaran, Montreal, Quebec; R. F. Dimmitt, Toronto, Ontario
V. P. in chg. Sales, J. M. Pritchard
Ch. Engr., R. C. Kinzer
Ch. Chem., G. R. Taylor
Ch. Engr., R. C. Kinzer
Pur. Agt., B. F. Stanton
Traf. Mgr., V. Smith
Refineries located at Montreal, Quebec, and Toronto, Ontario

R

Regal Petroleum Co., Ltd., 314 Insurance Exchange Bldg., Calgary, Alberta, Canada
Pres., Frank P. Book
V. P.s, A. E. O'Brien, E. L. Harvie
Sec., E. L. Harvie
Treas., A. E. O'Brien
Gen. Mgr., A. E. O'Brien
Supt., B. J. Manley
Station S. M., H. E. McDonald
Pur. Agt., F. R. Carey
Refinery located at Calgary, Alberta

S

Shell Oil Co. of British Columbia, Ltd., Vancouver, British Columbia, Canada
Pres., G. Legh-Jones
V. P.s, S. Belither, C. E. Anstie
Sec., G. E. McKinnon
Treas., D. Heggie
Supt., C. M. Dean, Burnaby, British Columbia
Refinery located at Burnaby, British Columbia

Shell Oil Co. of Canada, Ltd., 21 Dundas Square, Toronto, Ontario, Canada
Pres., P. M. Fowlie
Sec. and Treas., O. B. Roger
Supt., D. M. Morrison, Montreal, Quebec
Asst. Supt., E. W. Thompson, Montreal, Quebec
Tank Car S. M., J. A. Adamson
Gen. Sales Mgr., N. Y. Knox
Asst. Gen. Sales Mgr., T. D. Campbell
Ch. Engr., P. R. Reynolds
Ch. Chem., E. C. Wilkinson
Pur. Agt., P. E. Clayton
Operations Mgr., R. C. Geddes
Refinery located at Montreal, Quebec

Petroleum Refineries Operating in United States

Abbreviations Used in Operating Data

(Comp.)—Complete plant, gasoline, kerosene, gas oil, fuel oil, lubricating oils, paraffin, wax, petroleum coke, asphalt or both coke and asphalt, usually includes cracking. Some plants listed as complete do not manufacture asphalt or coke.
(S)—Gasoline, kerosene distillate, gas oil and fuel oil.
(L)—Gasoline, kerosene distillate, gas oil, fuel oil, and lubricating oils.
(A)—Gasoline, kerosene distillate, gas oil, fuel oil and asphalt.
(T)—Tops, distillates, gas oil and fuel oil.
(C)—Same products as skimming, except equipped for cracking.
(W)—Wax.
Where plant includes cracking, lubricating oil and asphalt, (S) is omitted as skimming is implied.

ARKANSAS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Berry Asphalt Co., Waterloo	2,000	.....	A-L	
Henry H. Cross Co., Smackover	6,000	2,000	C-L	Donnelly
Lion Oil Ref. Co., El Dorado	15,000	4,500	C	Lion
Macmillan Pet. Prod. Co., Norphlet	2,500	.....	L-A	
Root Ref. Co., El Dorado	12,000	5,500	C	Dubbs, Root
Stephens Ref. Co., Stephens	750	.....	S	
Total	38,250	12,000		

CALIFORNIA

Ajax Oil & Ref. Co., Long Beach	3,000	.....	S	
American Oil & Ref. Co., Hynes	2,500	.....	S	
Associated Oil Co., Associated	52,000	21,000	Comp.	Tube and Tank
Associated Oil Co., Wilmington	9,500	7,500	C	Tube and Tank
B. & F. Oil & Ref. Co., Venice	2,500	.....	A	
Bachman Pet. Corp., Long Beach	2,000	.....	S	
Bell View Oil Syndicate, Santa Fe Sp'gs	1,500	.....	S	
Bush, R. R., Refinery, Long Beach	3,500	.....	S	
Cameron, J. D., Taft	4,500	.....	S	
Caminol Co., Ltd., Santa Fe Springs	2,500	.....	S	
Caminol Co., Ltd., Hanford	2,500	.....	T	
Capitol Crude Oil Co., Santa Paula	150	.....	S	
Casmite Co., Casmalia	1,000	.....	A	
Eagle Oil & Ref. Co., Santa Fe Springs	1,000	.....	S	
Edington Oil & Ref. Co., Long Beach	4,400	.....	S	
Elm Oil Co., Ltd., Long Beach	800	.....	S	
Envoy Pet. Co., Long Beach	3,000	.....	S	
Estado Pet. Corp., Ltd., Long Beach	6,000	.....	S	
Exeter Ref. Co., North Long Beach	10,000	.....	L-A	
General Pet. Corp., Vernon	30,000	.....	S	
General Pet. Corp., Torrance	35,000	6,000	C	Kellogg
General Pet. Corp., Lebec	12,000	.....	S	
Gilmore Oil Co., Ltd., Los Angeles	2,500	.....	A	
Gilmore Oil Co., Ltd., Roadamite	700	.....	A	
Hancock Oil Co., Long Beach	12,500	.....	C	
Kolingo Refining Co., Coalinga	200	.....	L	
Lake View Oil & Ref. Co., Maricopa	3,000	.....	S	
Los Angeles Ref. Co., Bandini	2,000	.....	S	
Macmillan Pet. Corp., Long Beach	7,500	.....	S	
McOwen, Howard A., Long Beach	750	.....	S	
Mohawk Pet Co., Bakersfield	3,000	.....	S-A	
Monarch Refineries, Playa Del Rey	2,500	.....	S	
Norwalk Co., Maricopa	3,000	.....	S	
Olympic Ref. Co., Long Beach	6,000	.....	S	
Paraffine Co., Inc., Emeryville	1,200	.....	A	
Petrol Corp., Los Angeles	8,000	.....	A-L	
Pioneer Paper Co., Vernon	700	.....	A	
Posolube Ref. Co., Los Angeles	100	.....	A	
Rice Ranch Oil Co., Santa Maria	1,000	.....	A	
Richfield Oil Co., Watson	14,000	16,000	Comp.	Black
Richfield Oil Co., Hynes	55,000	14,000	C	Cross
Rio Grande Oil Co., Vinvale	10,000	3,000	C	Sinclair
San Fernando Ref. Co., Newhall	2,000	.....	A	
Seal Beach Ref. Co., Seal Beach	750	.....	S	
Seaside Oil Co., Ventura	5,000	.....	A	
Shell Oil Co., Wilmington	35,000	18,400	C-A	Dubbs
Shell Oil Co., Martinez	36,500	23,000	Comp.	Dubbs
Shell Oil Co., Coalinga	3,800	.....	S	
Shell Oil Co., Dominguez	.....	34,800	C	Dubbs
Socal Oil & Ref. Co., Huntington Beach	3,000	.....	S	
Standard Oil Co. of Calif., Richmond	100,000	40,900	Comp.	Dubbs
Standard Oil Co. of Calif., El Segundo	100,000	77,600	Comp.	Dubbs
Standard Oil Co. of Calif., Bakersfield	25,000	.....	A	
Sterling Ref. Co., Bandini	750	.....	S	
St. Helens Pet. Co., Ltd., Pico (Los Angeles County)	5,000	.....	A	
Super Asphalt Products Co., Long Beach	500	.....	A	
Terra Bella Ref. Co., Ltd., Terra Bella	400	.....	L	
Texas Co. (Calif.), Los Angeles	30,000	5,500	C	Holmes-Manley
Texas Co. (Calif.), Fillmore	4,000	2,700	C	Cross
Triangle Oil & Ref. Co., Venice	3,000	.....	T	
Union Oil Co. (Calif.), Wilmington	51,000	12,000	C-A	Cross*
Union Oil Co. (Calif.), Oleum	17,000	.....	A-L	
Union Oil Co. (Calif.), Bakersfield	5,000	.....	A	
Union Oil Co. (Calif.), Santa Paula	1,200	.....	S	
Walter Steiner Ref. Co., Long Beach	1,500	.....	L	
Western Oil & Ref. Co., Wilmington	12,000	4,200	C	Jenkins
White Star Oil & Ref. Co., Long Beach	1,500	.....	S	
Wilshire Oil Co., Vernon	20,000	.....	S	
Total	784,750	286,600		

*Plant also includes seven residuum topping and viscosity units having charging capacity of 22,000 bbls. daily.

COLORADO

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Continental Oil Co., Florence	2,000	1,300	C	Burton
Continental Oil Co., Denver	1,500	1,000	C	Cross
McGarr Pet. Corp., Kline	180	.....	S	
Midland Oil Ref. Co., Denver	1,500	.....	A	
Raven Oil & Ref. Co., Rangely	200	.....	S	
Standard Oil Co. (Indiana), Florence	.....	*1,300	C	Burton
Texas Co., Craig	1,000	1,000	C	Holmes-Manley
Total	6,380	4,600		

*Cracking plant operated in connection with Continental Oil Co.

GEORGIA

Atlantic Ref. Co., Brunswick	5,000	3,600	Comp.	Lewis
Pan American Pet. & Trans. Co., Savannah	4,000	.....	A	
Total	9,000	3,600		

ILLINOIS

Cross, Henry H., Co., Joliet	2,000	.....	S	
Cross, Henry H., Co., Dupo	1,000	.....	S	
Globe Oil & Ref. Co., Lemont	12,000	6,000	C	Winkler-Koch
Indian Ref. Co., Lawrenceville	16,000	7,300	Comp.	Cross, deFlorez
Lincoln Oil Ref. Co., Robinson	10,000	12,000	Comp.	Holmes-Manley
Red River Ref. Co., Inc., Burnham	1,200	.....	L	
Shell Pet. Corp., Wood River	38,000	25,450	Comp.	Dubbs, T.V.P.,
Socony-Vacuum Oil Co., Inc., (Lubrite) East St. Louis	4,750	3,200	S-C	Pratt Vapor Phase Cross
Standard Oil Co. (Indiana), Wood River	17,000	20,780	Comp.	Holmes-Manley
Texas Co., Lockport	20,000	16,000	Comp.	Holmes-Manley, deFlorez, Pressure Coke
Total	121,950	90,730		

INDIANA

Empire Oil & Ref. Co., East Chicago	25,000	15,000	C	Doherty
Shell Pet. Corp., East Chicago	28,500	22,000	C-A	Dubbs
Sinclair Ref. Co., East Chicago	40,000	28,500	Comp.	Sinclair 600
Standard Oil Co. (Indiana), Whiting	93,000	88,000	Comp.	Holmes-Manley, Continuous Combination
Troy Ref. Co., Troy	150	.....	A	
Wadhams Oil Co., East Chicago	6,000	4,700	C	Jenkins, Naphtha Reformer, Own Vapor Phase
Total	192,650	158,200		

KANSAS

Barnsdall Refineries, Inc., Wichita	5,000	1,500	C	Dubbs
Derby Oil Co., Wichita	8,000	2,000	C-A	Dubbs
Dickey Ref. Co., McPherson	3,500	1,700	C	Dickey
Eldorado Ref. Co., Eldorado	5,000	2,500	C	Winkler-Koch
Falcon Refining Co., Great Bend	800	.....	S	
Globe Oil & Ref. Co., McPherson	12,000	6,000	C	Winkler-Koch
Golden Rule Ref. Co., Wichita	1,000	500	C	Jenkins
Kanotex Ref. Co., Arkansas City	12,000	4,000	C	Donnelly
Kansas Gas & Gasoline Co., Winfield	500	.....	S	
Kreuger Refining Co., Laton	150	.....	S	
National Ref. Co., Coffeyville	8,000	4,000	Comp.	National
Petroleum Products Co., Chanute	1,000	.....	S	
Phillips Pet. Co., Kansas City	18,000	11,000	C	Dubbs, Own
Shell Pet. Corp., Arkansas City	20,000	9,000	C	Dubbs
Sinclair Ref. Co., Coffeyville	12,000	9,000	Comp.	Sinclair 600
Sinclair Ref. Co., Kansas City	11,000	9,000	C	Sinclair 600
Skelly Oil Co., Eldorado	20,000	28,000	C-A	Winkler-Koch, Jenkins, Skelly-Rittman, Vapor Phase
Socony-Vacuum Oil Co., Inc., (White Eagle) Augusta	16,000	10,000	Comp.	White Eagle
Standard Oil Co. (Indiana), Neodesha	7,500	8,570	C	Holmes-Manley Cracking Coil
United Oil & Ref. Co., Hutchinson	1,500	.....	S	
Vickers Pet. Co., Potwin	3,500	1,500	C	Dubbs
Total	166,450	108,270		

KENTUCKY

Aetna Oil Service, Inc., Louisville	2,000	600	C	Fleming
Ashland Ref. Co., Inc., Catlettsburg	4,700	2,200	C-A	Dubbs
Bowling Green Ref. Co., Memphis Junc.	1,500	.....	S	
Glasgow Oil & Ref. Co., Glasgow	250	.....	S	
Greenville Ref. Co., Greenville	100	.....	S	
Louisville Ref. Co., Inc., Louisville	4,500	2,000	C	Dubbs
Simrall Ref. Corp., Horse Cave	2,500	.....	S	
South Kentucky Pipe Line Co., Somerset	400	.....	S	
Standard Oil Co. (Ohio), Latonia	8,000	5,000	C-A	Tube & Tank
Stoll Oil Ref. Co., Louisville	2,500	1,000	Comp.	Own
Texas Co., Pryse	2,500	2,000	C	Holmes
Total	28,950	12,800		

(Continued on Next Page)

LOUISIANA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Bayou State Ref. Corp., Houston	750	.....	L	
Chalmette Pet. Corp., Chalmette	7,500	4,000	C	Winkler-Koch
Griswold Refinery, Shreveport	2,500	1,000	S	Own
Louisiana Oil Ref. Corp., Bossier City	23,000	22,000	C	Tube & Tank
Oil Refineries, Inc., Haughton	1,000	.....	S	
Pan American Southern Corp., Destrehan	16,000	.....	A	
Shell Pet. Corp., Norco	21,000	10,000	C-A	Dubbs
Spartan Ref. Co., Shreveport	12,000	6,000	C	Gyn
Stanolind Oil & Gas Co., Superior	4,500	2,000	C	Cross
Standard Oil Co. of La., Baton Rouge	100,000	40,000	Comp.	Tube & Tank
Texas Co., Ardis (Shreveport)	7,000	.....	S	
Total	195,250	85,000		

MARYLAND

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Continental Oil Co., Baltimore	10,000	7,000	C	Dubbs, Cross
Pan American Pet. & Trans. Co., Baltimore	8,000	.....	A	
Standard Oil Co. of New Jersey, Baltimore	37,000	52,572	Comp.	Tube & Tank
Total	55,000	59,572		

MASSACHUSETTS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Cities Service Ref. Co., East Braintree	20,000	6,300	Comp.	Doherty, Holmes-Manley
Colonial Beacon Oil Co., Everett	28,000	28,000	C-A	Tube & Tank
Total	48,000	34,300		

MICHIGAN

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Keystone Oil Ref. Co., Detroit	1,500	.....	L	
Max Pray, Wyman	1,000	.....	S	
McClanahan Refs., Inc., St. Louis	2,500	.....	S	
Midwest Refs., Inc., Alma	2,000	.....	S	
Naph-Sol Ref. Co., Muskegon	2,500	*1,000	C	Dubbs
Old Dutch Ref. Co., Muskegon	3,000	.....	S	
Pure Oil Co., Midland	3,500	.....	T	
Roosevelt Oil Co., Mount Pleasant	5,000	.....	L	
Socony-Vacuum Oil Co., Inc., (White Star) Trenton	7,000	6,600	C	Dubbs, Controlled Coil
Total	28,000	7,600		

*Under construction.

MISSOURI

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Altitude Pet. Corp., Kansas City	3,500	2,400	C	Burton and Miehl
Joplin Ref. Co., Joplin	1,500	1,000	C	Jenkins
Standard Oil Co. (Ind.), Sugar Creek	16,500	23,000	Comp.	Burton, Holmes-Manley
Total	21,500	26,400		

MONTANA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Arro Oil & Ref. Co., Lewistown	2,000	500	C	Dubbs
B & M Refining Co., Roundup	300	.....	S	
Bighorn Oil & Ref. Co., Billings	400	.....	S-A	
Big West Oil Co., Kevin	1,000	500	C	Dubbs
Conrad Ref. Co., Conrad	1,000	.....	S	
Consumers Ref. Co., Collins	500	.....	S	
Continental Oil Co., Lewistown	1,500	.....	S	
Cut Bank Refining Co., Cut Bank	250	.....	S	
Dunlap Ref., Cat Creek	75	.....	S	
Fern Oil Co., Thermopolis	5,000	.....	Comp.	
Hart Refineries, Hedgesville	100	.....	S	
Hart Refineries, Missoula	300	.....	S	
Home Oil & Ref. Co., Great Falls	1,000	750	C	Dubbs
Independent Ref. Co., Laurel	5,000	1,500	C-A	Donnelly
Minntana Oil Co., Molt	30	.....	S	
River Dome Oil Co., Roundup	25	.....	S	
Russell Oil Co., Butte	500	.....	S	
Russell Oil Co., Billings	1,000	.....	S	
Snow Cap Oil Co., Sunburst	330	200	C	Own
Texas Co. (International), Sunburst	3,000	2,000	C	deFlorez
Toole County Ref. Co., Oilmont	300	.....	S	
Unity Pet. Co., Kalispell	1,800	800	C	Vapor Phase
Unity Pet. Co., Havre	200	.....	S	
Yale Oil Corp. of S. Dak., Billings	2,000	.....	S	
Total	27,610	6,250		

NEBRASKA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Carpenter, Terry, Scottsbluff	75	.....	S	

NEW JERSEY

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Barber Asphalt Co., Maurer*	10,000	3,000	C-A	
Crew Levick Co., Petty Island	10,000	4,500	Comp.	Doherty
Middlesex Ref. Co.	5,000	.....	C	
Standard Oil Co. of N. J., Bayonne	70,000	29,714	Comp.	Tube & Tank
Standard Oil Co. of N. J., Linden	70,000	172,571	Comp.	Tube & Tank
Standard Oil Co. of N. J., Jersey City	15,000	.....	L-W	
Tide Water Oil Co., Bayonne	50,000	25,000	Comp.	Tube & Tank
Vacuum Oil Co., Inc., Paulsboro	20,000	9,000	Comp.	Cross, Ellis
Warner-Quinlan Oil Co., Warners	18,500	.....	S-A	
Total	268,500	243,785		

*Cracking plant operated by Bertrin Petroleum Co.

NEW MEXICO

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Aerex Co., Bloomfield	100	.....	S	
Basin Ref. Co., Aztec	100	.....	S	
Continental Oil Co., Farmington	1,000	.....	S	

(Continued on Next Page)

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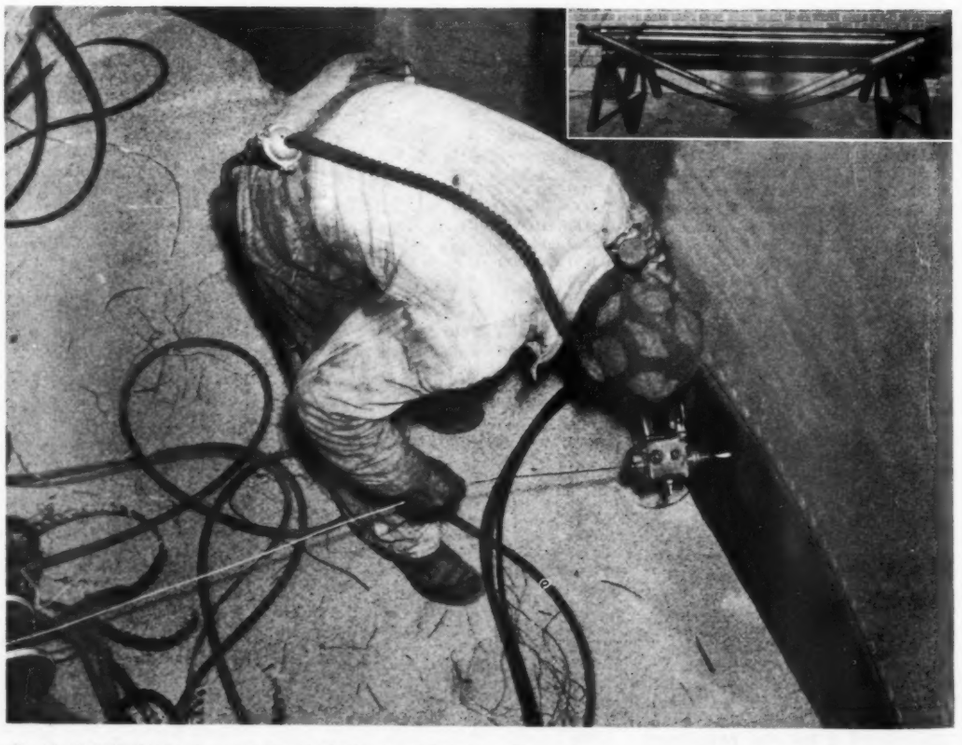

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Mid-Continent Distributors for
METALLIZING COMPANY OF AMERICA, Inc., Los Angeles, Calif.
Export Office: 44 Whitehall, New York City

NEW MEXICO (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Continental Oil Co., Artesia	1,500	.....	S	
Continental Oil Co., Albuquerque	1,000	.....	S	
Malco Ref., Inc., Artesia	2,000	.....	S	
McNutt Oil & Ref. Co., Brickland	1,000	500	C	Donnelly
Pecos Diamond Ref. Co., Artesia	250	.....	S	
Valley Ref. Co., Roswell	300	.....	S	
Total	7,250	500		

NEW YORK

Allegany Refiners, Inc., Bolivar	1,200	.....		
Gulf Ref. Co., Staten Island	15,000	.....	S	
Sinclair Ref. Co., Wellsville	10,000	6,000	Comp.	Sinclair 600
Standard Oil Co. of N. Y., Brooklyn and Long Island City	19,000	10,000	Comp.	Cross, deFlorez
Standard Oil Co. of N. Y., Buffalo	5,000	4,000	Comp.	Cross, deFlorez
Vacuum Oil Co., Inc., Olean	6,500	3,000	Comp.	Cross, Ellis
Total	56,700	23,000		

OHIO

Canfield Oil Co., Cleveland	1,000	.....	L	
Gulf Ref. Co., Toledo	13,000	13,000	C	Gulf
Gulf Ref. Co., Cincinnati	13,000	13,000	C-A	Gulf
National Ref. Co., Findlay	3,200	1,350	Comp.	National
National Refining Co., Marietta	700	.....	L-W	
Peninsula Oil Co., Catawba Island	20	.....	S	
Pure Oil Co., Heath	10,000	9,400	C	Gyro, Cross
Pure Oil Co., Toledo	9,500	8,000	C	Gyro
Standard Oil Co. of Ohio, Cleveland	24,000	10,000	Comp.	Tube & Tank
Standard Oil Co. of Ohio, Toledo	12,000	4,500	Comp.	Tube & Tank
Standard Oil Co. of Ohio, Lima	7,500	4,000	C	Solar
Sun Oil Co., Toledo	14,000	6,000	S-C	Sun
Wayco Ref. Co., Toledo	250	.....	L	
Total	108,170	69,250		

OKLAHOMA

Anderson-Prichard Oil Corp., Cyril	6,000	3,000	C	Winkler-Koch
Barnsdall Refs., Inc., Okmulgee	11,000	4,500	C	Cross
Barnsdall Refs., Inc., Barnsdall	5,000	4,000	C-L-W	Cross
Bell Oil & Gas Co., Grandfield	4,500	1,700	C	Dubbs
Black Gold Ref. Co., Oklahoma City	2,500	1,000	C	Dubbs
Century Pet. Co., Oklahoma City	2,500	.....	S	
Champlin Ref. Co., Enid	15,000	6,000	C-L-W	Cross, Winkler-Koch
Cole, L. S., Ref. Co., Oklahoma City	500	.....	S	
Columbus Ref. Co., Oklahoma City	2,500	.....	S	
Continental Oil Co., Ponca City	30,000	13,000	Comp.	Dubbs, Cross
Cushing Ref. & Gaso. Co., Cushing	4,500	2,200	C	Dubbs
Cushing Ref. & Gaso. Co., Blackwell	1,700	.....	S	
Deep Rock Oil Corp., Cushing	10,000	4,000	Comp.	Dubbs
Eason Oil Co., Enid	5,000	2,000	C	Jenkins
Empire Oil & Ref. Co., Okmulgee	4,000	1,000	Comp.	Doherty
Empire Oil & Ref. Co., Ponca City	12,000	4,500	Comp.	Dubbs, Doherty
Firestone Ref. Co., Oklahoma City	2,000	.....	S	
Government Ref. Co. No. 2, Oklahoma City	3,500	.....	S	
Hanger Ref. Co., Oklahoma City	1,000	.....	S	
Johnson Oil Ref. Co., Cleveland	6,000	2,000	C	Dubbs
Knox Ref. Co., Covington	250	.....	S	
Major Petroleum Products Co., Oklahoma City	1,500	.....	S	
Marathon Oil Co., Bristow	5,000	1,500	C	Kellogg
Mid-Continent Pet. Corp., Tulsa	40,000	17,500	Comp.	Mid-Continent
Oklahoma City Ref. Co., Oklahoma City	2,500	.....	S	
Omar Ref. Co., Garber	5,000	3,000	C	Own
Phillips Pet. Co., Okmulgee	6,000	3,000	C-L	Dubbs
Pilgrim, Inc., Ardmore	70	.....	L	
Pure Oil Co., Muskogee	9,000	6,700	Comp.	Cross, Gyro
Rock Island Ref. Co., Beckett	6,500	2,000	C	Winkler-Koch
Sinclair Ref. Co., Sand Springs	8,000	4,000	Comp.	Cross
Sooner State Ref. Co., Oklahoma City	300	.....	S	
Sun Oil Co., Yale	5,000	.....	S	
Sunray Oil Co., Allen	6,000	2,000	C-A	Dubbs
Texas Co., West Tulsa	14,000	13,600	Comp.	Holmes-Manley,
Texas Pacific Coal & Oil Co., Wynnewood	3,000	.....	A	Pressure Coke
Tide Water Oil Co. of Okla., Drumright	15,000	7,000	C	Tube & Tank
Triangle Prod. & Ref. Co., Oklahoma City	1,000	.....	S	
Western Oil Corp., Beckett	2,000	1,200	C	Jenkins
Wilcox, H. F., Oil & Gas Co., Bristow	6,000	1,500	C	Dubbs
Wirt Franklin Pet. Corp., Ardmore	4,000	.....	S	
Total	269,320	111,900		

PENNSYLVANIA

Atlantic Ref. Co., Philadelphia	70,000	32,800	Comp.	Lewis, Cross, deFlorez Kellogg
Atlantic Ref. Co., Franklin	9,000	6,000	Comp.	Cross
Atlantic Ref. Co., Pittsburgh	8,000	4,000	Comp.	Cross
James B. Berry Sons Co., Inc., Oil City	2,500	.....	S-L	
Bradford Oil Ref. Co., Bradford	2,000	.....	S-L	
Bradford Penn Ref. Corp., Clarendon	1,000	.....	L-W	
Canfield Oil Co., Coraopolis	1,500	.....	L	
Carnegie Ref. Co., Carnegie	1,000	.....	Comp.	

PENNSYLVANIA (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Conewango Ref. Co., Warren	2,000	.....	L	
Continental Ref. Co., Oil City	1,000	*2,500	Comp.	Dubbs
Crew-Levick Co., Titusville	3,000	.....	Comp.	
Crystal Oil Works, Rouseville	1,000	.....	L-W	
Daugherty, W. H., & Son Ref. Co., Petrolia	2,000	.....	L	
Franklin Creek Ref. Co., Franklin	1,500	.....	L	
Freedom Oil Works Co., Freedom	2,500	.....	L-W	
Gulf Ref. Co., Philadelphia	30,000	33,600	C-L	Gulf
Gulf Ref. Co., Pittsburgh	10,000	5,200	C	Gulf
Kendall Ref. Co., Bradford	3,500	2,300	Comp.	Dubbs
Miller, A. D., Sons Co., Pittsburgh	1,000	.....	L	
Oil Creek Refining Co., East Titusville	1,800	.....	L-W	
Pennsylvania Oil Products Co., Eldred	5,000	1,000	S-C-L	Conerty
Pennsylvania Ref. Co., Karns City	2,000	.....	L-W	
Pennsylvania Ref. Co., Titusville	1,500	.....	L	
Pennzoil Co., The, Oil City	8,000	5,000	L	Dubbs
Pure Oil Co., Marcus Hook	16,000	13,400	Comp.	Gyro, Cross
Quaker State Oil Ref. Corp., Farmers Valley	2,500	1,250	Comp.	Dubbs
Quaker State Oil Ref. Corp., Emlenton	2,000	1,000	Comp.	Dubbs
Sinclair Ref. Co., Marcus Hook	28,000	29,500	C	Sinclair 600
Sloan & Zook Ref. Co., Warren	1,500	.....	L-W	
Superior Oil Works, Warren	500	.....	L-W	
Starlight Ref. Co., Karns City	600	.....	L	
Sun Oil Co., Marcus Hook	63,000	15,000	Comp.	Sun
Texas Co., Marcus Hook	2,000	.....	A	
Tiona Ref. Co., Clarendon	1,000	.....	Comp.	
Ultra-Penn Ref. Co., Bruin	1,000	.....	Comp.	
United Ref. Co., Warren	3,000	500	Comp.	Dubbs
Valvoline Oil Co., Butler	3,000	.....	Comp.	
Valvoline Oil Co., Franklin	.....	.....	Grease	
Warr-Pen Ref. Co., Warren	1,200	.....	S	
Waverly Oil Works Co., Pittsburgh	1,000	600	Comp.	Cross
Wolverine-Empire Ref. Co., Reno	2,500	.....	Comp.	
Total	299,600	153,650		

*Cracking plant owned jointly by Pennzoil Co., James B. Berry Sons Co., Inc., Wolverine, Empire Refining Co. and Continental Refining Co.

RHODE ISLAND

Socony-Vacuum Oil Co., Inc., (Standard New York) Providence	9,000	4,000	A-C	Cross
Texas Co., Providence	2,000	.....	A	
Total	11,000	4,000		

(Continued on Next Page)

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SOUTH CAROLINA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Standard Oil Co of N. J., Charleston ..	6,500	.....	A	

SOUTH DAKOTA

Rex Oil Ref., Inc., Rapid City	100	.....	S	

TEXAS

Acme Ref. Co., Gladewater	700	.....	S	
Aero Ref. Co., Pecos	225	.....	S	
Airolene Gasoline Corp., Magic City	250	....		
All State Ref. Co., Thrall	3,000	.....	S	
Alton Ref. Co., Gladewater	1,500	.....	S	
American Pet. Co., Houston	4,000	.....	S	
Amsco Ref. Co., Mirando City	2,500	1,200	C-L	Own
Archer Ref. Corp., Megargel	1,000	.....	S	
Arpana Ref. Co., Arp	4,000	.....	S	
Arrow Ref. & Prod. Co., Overton	5,000	2,500	C-S	
Atlantic-Pacific & Gulf Ref. Co., Wichita Falls	5,000	1,250	C	Jenkins
Baird Ref. Co., Baird	1,400	1,000	C	Dayson
Beacon Oil & Ref. Co., Henderson	4,500	.....	S	
Bee Oil & Ref. Co., Pettus	800	.....	S	
Blue Diamond Ref. Co., Gladewater	1,500	.....	S	
Bonita Ref. Co., Joinerville	500	.....	S	
C. L. & W. Ref. Co., Gladewater	1,300	.....	S	
Canyon Oil & Gas Co., Inc., Cisco	600	.....	S	
Canyon Ref. Co., Kilgore	200	.....	S	
Century Ref. Co., Friars Switch	2,300	.....	S	
Chapa Ref. Co., Laredo	100	.....	S	
Chief Refining Co., Inc.	1,500	.....	S	
Coltex Ref. Co., Colorado	10,000	4,000	S-C	Std. of Calif.
Concho Ref. Co., San Angelo	200	.....	S	
Condor Ref. Co., Kilgore	1,000	.....	S	
Conroe Oil & Ref. Co., Conroe	250	.....	S	
Consolidated Ref. Co., Gladewater	1,500	.....	S	
Continental Oil Co., Wichita Falls	5,000	2,300	C	Cross
Corpus Christi Ref. Co., Corpus Christi.	1,000	500	C	Own
Cosden Oil Co., Big Spring	12,000	4,000	C-A	Donnelly
Crown Central Pet. Corp., Houston	8,000	6,000	C-L	Holmes-Manley
Culver Ref. Co., Gladewater	3,700	.....	S	
Danciger Refineries, Inc., Pampa	7,000	4,000	C	Bidison-Boyd
Deepwater Oil Refineries, Inc.	3,000	.....	L	
East Texas Ref. Co., Longview	10,000	4,000	S-C	Donnelly
Exchange Pet. Co., Albany	500	.....	S	
Falls Refining Co., Wichita Falls	2,500	.....	S	
Gilliland Oil Co., Gladewater	3,500	1,500	S-C	Own

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Godlin Ref. Co., Gladewater	850	.....	S	
Goldman Ref. Co., Gladewater	1,100	.....	S	
Goodson-Gentry Ref. Co., Gladewater ..	850	.....	S	
Gratex Ref. Co., Graham	300	.....	S	
Gulf Ref. Co., Port Arthur	100,000	50,000	Comp.	Gulf
Gulf Ref. Co., Fort Worth	6,000	3,000	C	Gulf
Gulf Ref. Co., Sweetwater	5,000	4,000	C	Gulf
Haskell Oil Ref. Corp., Breckenridge ...	200	.....	S	
Hausman, Louis, Oil Co., N. Laredo	40	.....	S	
Hill Ref. Co., Ballinger	45	.....	S	
Houston Oil Co. of Texas, Corpus Christi	1,000	.....	S	
Howard County Ref. Co., Big Spring ..	2,000	.....	S	
Hub Ref. Co., Reed's Switch	100	.....	S	
Humble Oil & Ref. Co., Ingleside	15,000	8,000	C	Tube & Tank
Humble Oil & Ref. Co., Baytown	115,000	60,600	Comp.	Cross, Tube & Tank
Humble Oil & Ref. Co., San Antonio ...	4,500	.....	S	
Humble Oil & Ref. Co., Neches	5,000	.....	S	
Illinois Ref. Co., Kilgore	1,000	.....	S	
Jacksboro Ref. Co., Jacksboro	50	.....	S	
Jackson Ref. Co., Gladewater	1,500	.....	S	
Johnson Ref. Co., Kilgore	1,000	.....	S	
Keystone Ref. Co., Gladewater	1,000	.....	S	
Kilgore Ref. Co., Kilgore	1,500	750	C	
Lake Ref. Co., Gladewater	2,000	.....	S	
La Pren Ref. Co., Kilgore	1,500	.....	S	
LaSalle Pet. Co., Burkburnett	3,000	.....	S	
Linzie Ref. Co., Gladewater	2,500	.....	S	
Lone Star Ref. Co., Gladewater	2,700	1,000	S-C	Own
Magnolia Pet. Co., Beaumont	80,000	55,000	Comp.	Cross
Magnolia Pet. Co., Fort Worth	6,000	3,500	C	Cross
Magnolia Pet. Co., Corsicana	3,500	.....	S	
Magnolia Pet. Co., Luling	5,000	3,750	C	Controlled Coil
Marathon Oil Co., Fort Worth	5,000	1,500	C-L-W	Kellogg
Maritime Oil Co., Houston	3,000	.....	L-A	
Master Pet. Co., Waco	1,000	.....	S	
McKain Fuel Oil Co., Gladewater	800	.....	S	
McMurray Ref. Co., Arp.	4,000	2,000	S-C	Own
McNutt Ref. Co., El Paso	2,000	.....	S	
Mentone Oil & Ref. Co., Arno	1,000	.....	S	
Minerva Ref. Co., Minerva	2,000	.....	S	
Moutray Oil Co., Hawley	600	.....	S	
Muenster Ref. Co., Muenster	300	.....	S	
Nolting Ref. Co., Sweetwater	1,000	.....	S	

(Continued on Next Page)

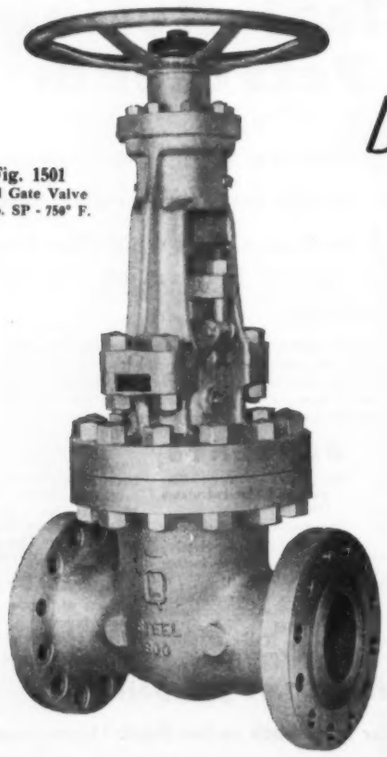


Fig. 1501
Steel Gate Valve
900 lb. SP - 750° F.

Designed for the Modern Refinery~~~

LUNKENHEIMER
Steel Valves

The modern refinery - carefully planned for increased efficiency, larger capacity, and higher operating pressure and temperature - demands equipment designed specifically for its needs.

Lunkenheimer Steel Valves are available in types and sizes to satisfy all present-day requirements, at pressures from 150 to 1500 lb. and temperatures up to 1000° F. The line includes gate, globe and angle, swing check and piston check valves in all commercial sizes.

As no combination of materials should be recommended for all conditions, a choice of materials as well as types is offered. Bodies and bonnets may be made of carbon or alloy steels, and trimmings of various alloys selected to suit the installation. Valves may be constructed for flanged or welded piping and equipped with motor control or gearing.

The Lunkenheimer Company is prepared to assist you in refinery valve problems. Write for information.

THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI, OHIO, U. S. A.
NEW YORK CHICAGO BOSTON
PHILADELPHIA SAN FRANCISCO
EXPORT DEPT 318-322 HUDSON ST., NEW YORK

LUNKENHEIMER VALVES

15-64-91

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Oil Refineries, Inc., Overton	4,000	2,000	C	Own
Olney Oil & Ref. Co., Olney	3,000	1,500	C	Donnelly
Omega Ref. Co., Brownwood	130	.....	S	
Oriental Oil Co., Dallas	1,500	1,500	S-C	Floyd
Overton Ref. Co., Overton	3,000	750	S-C	Overton
Ozozo Ref. Co., Friars Switch	10,000	.....	S	
Panama Ref. Co., Kilgore	3,000	.....	S	
Pan American Pet. & Trans. Co., Texas City	25,000	25,000	C	Combination
Panhandle Ref. Co., Wichita Falls	3,400	1,800	C	Dubbs
Panhandle Ref. Co., Kings Mill	2,000	.....	S	
Paragon Refining Co., Leuders	400	.....	S	
Paramount Refineries, San Angelo	2,000	.....	S	
Pasotex Pet. Co., El Paso	14,000	4,000	C	Dubbs
Pennant Ref. Co., Kilgore	1,300	.....	S	
Pentex Ref. Co., Echo	400	.....	S	
Phillips Pet. Co., Borger	50,000	48,000	C-A	Phillips
Phoenix Ref. Co., Houston	1,000	.....	S	
Phoenix Ref. Co., Pettus	600	.....	S	
Phoenix Ref. Co., Pettus	1,000	.....	S	
Phoenix Ref. Co., Inc., Dallas	1,000	.....	S	
Phoenix Ref. Co., San Antonio	500	.....	S	
Pilot Point Ref. Co., Pilot Point	500	.....	S	
Pine Ref. Co., Camp Switch	2,500	.....	S	
Pioneer Oil & Ref. Co., Somerset	2,150	.....	L	
Plainview Ref. Co., Plainview	1,000	.....	S	
Price Ref. Co., San Antonio	500	.....	S	
Primrose Refining Co., Wichita Falls	2,500	.....	S	
Pure Oil Co., Smiths Bluff (Nederland)	30,000	27,000	C	Gyro
Rado Ref. & Prod. Co., McAllen	500	.....	L	
Recla Ref. Co., Turnerstown	200	.....	S	
Republic Oil & Ref. Co., Texas City	5,000	3,000	C	Winkler-Koch
Roco Ref. Co., Kilgore	1,200	.....	S	
Sabine Refining Co., Gladewater	200	.....	S	
San Angelo Ref. Co., San Angelo	2,000	.....	S	
Security Pet. Co., Chase	3,100	.....	S	
Shamrock Oil & Gas Co., Meldavis	1,200	.....	S	
Shamrock Oil & Gas Co., Sunray	2,000	.....	S	
Shell Pet. Corp., Houston	42,000	21,000	C	Dubbs
Shoreline Ref. Co., Kilgore	2,700	.....	S	
Sinclair Ref. Co., Gladewater	2,500	.....	S	
Sinclair Ref. Co., Houston	44,000	43,000	Comp.	Sinclair 600
Sinclair Ref. Co., Fort Worth	4,000	3,000	C	Sinclair 600
Sinclair Ref. Co., El Paso	4,000	.....	S	
Southern Refining Co., Overton	3,000	.....	S	
Southport Ref. Co., Kilgore	3,300	1,500	S-C	Own
Star Ref. & Prod. Co., Fort Worth	1,200	600	C	Donnelly
Stone Oil Co., Texas City	7,500	2,500	C	Jenkins
Superior Ref. Co., Tiffin	800	.....	S	
Supreme Ref. Co., Gladewater	1,000	.....	S	
Texas Co., Port Arthur	75,000	95,600	Comp.	Holmes-Manley, deFlorez, Pressure Coke
Texas Co., West Dallas	16,000	9,200	C	Holmes-Manley, deFlorez, Pressure Coke
Texas Co., Amarillo	4,000	2,400	C	Pressure Coke, deFlorez
Texas Co., Port Neches	20,000	.....	A	
Texas Co., Houston	20,000	1,000	C	Tube & Tank
Texas Co., San Antonio	4,000	4,000	C	Holmes-Manley
Texas Co., El Paso	1,500	1,500	C	Holmes-Manley
Texas Oil Products Co., Gladewater	4,000	2,000	S-C	Own
Texas Pacific Coal & Oil Co., Fort Worth	3,500	1,000	C-L	Cross
Texas Pacific Coal & Oil Co., Caddo	800	.....	S	
Texas Pet. Products Co., Somerset	2,000	.....	S	
Tucker Oil Co., Burkburnett	350	.....	S	
Trico Ref. Co., Turnerstown	200	.....	S	
Trio Ref. Co., Arp.	1,500	700	S-C	Own
Trinity Refining Co., Gladewater	2,000	1,000	C	Lummus
Tucker Oil Co., Burkburnett	250	.....	S	
Tyler Ref. Co., Arp	2,000	.....	S	
Tyler Texas Oil & Ref. Co., Tyler	15,000	7,000	S-C	Own
Tyreco Ref. Co., No. 1, Arp	2,500	1,000	S-C	Own
Tyreco Ref. Co. No. 2, Overton	3,000	1,500	S-C	Own
Union Ref. Co., Camp Switch	3,000	.....	S	
Unit Ref. Co., Kilgore	200	.....	S	
Upshur Ref. Co., Gladewater	750	1,250	S	
Utah Ref. Co., Kilgore	2,500	.....	S	
Valley Ref. Co., Harlingen	1,000	.....	S	
Waggoner Ref. Co., Inc., Electra	6,000	.....	S	
White Star Ref. Co., Cisco	500	.....	S	
Wichita Ref. Co., Gladewater	500	.....	S	
Wickett Ref. Co., Wickett	2,000	.....	S	
Total	992,790	540,650		

†Owned by Pecos Refining Co. .....

UTAH

Jenson Oil Ref. Co.	1,000	600	C-L	Own
Utah Oil Ref. Co., Salt Lake City	6,000	6,500	Comp.	Modified Holmes-Manley
Wasatch Oil Ref. Co., Woods Cross	1,400	900	C	Vapor Phase
Total	8,400	8,000		

VIRGINIA

Texas Co., Norfolk	2,000	.....	A	

(Continued on Next Page)

Hold Top Tower temperature *Exactly*

with

MASON-NEILAN CONTROLLER

NO. 3000-B

You have definitely licked that tough old trouble-maker—top tower temperature control—when you install a Mason-Neilan No. 3000-B Controller. For this outstanding instrument rules obstinate tower temperatures with an iron hand regardless of load fluctuations or changes in operating conditions. Variable factors, which continually upset ordinary control instruments, are quickly tamed by Mason-Neilan's exclusive Thermo-Pressure and Drift Compensation.

Distinctive design features include the use of one helical coil to operate the control mechanism and another to actuate the recording pen—a feature that eliminates entirely the lag effect caused by pen friction.

The 3000-B Controller can be equipped with an Overheat Protector —a new safety feature that positively protects the thermal element from injury if tower temperatures exceed the instrument range. As a result, sensitive vapor tension thermal systems can be used *with full safety up to 750° F.*

Mason-Neilan Engineers, with years of specialized experience in the oil industry, can be of real help in solving your next problem involving the control of pressure, temperature, flow or liquid level. They'll be glad to work with you.

MASON-NEILAN
REGULATOR COMPANY
1190 Adams Street, Boston, Mass.

YOU CAN BE SURE OF MASON-NEILAN PRODUCTS

WEST VIRGINIA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Carbide & Carbon Chemicals Corp., South Charleston	1,000	1,000	C	Gyro
Elk Ref. Co., Falling Rock	2,500	.....	L-W	
Ohio Valley Ref. Co., St. Marys	2,000	750	Comp.	Dubbs
Pure Oil Co., Cabin Creek	3,500	1,500	Comp.	Gyro
Standard Oil Co. of N. J., Parkersburg	6,000	13,714	L-A	Tube & Tank
Total	15,000	16,964		

WYOMING

C. & H. Refinery, Lusk	75	.....	S	
Continental Oil Co., Glenrock	2,500	1,800	C	Cross
Eclipse Oil & Ref. Co., New Castle	250	.....		
Egaso Operating Co., Osage	750	.....	S-C	Cross
Goshen Oil Ref. Co., Torrington	250	.....	S	
Gillette Ref. Co., Gillette	250	.....	S	
Gillette Ref. Co., New Castle	100	.....	S	
Gillette Ref. Co., Sheridan	250	.....	S	
Midland Oil Ref. Co., Osage	300	.....	S	
Northwestern Pet. Co., Osage	300	.....	S	
Oreana Ref. Co., LaBarge	100	.....	S	
Sinclair Ref. Co., Parco	8,000	4,000	C	Dubbs
Socony-Vacuum Oil Co., Inc., White Eagle Division	5,000	3,500	Comp.	White Eagle
Standard Oil Co. (Ind.), Casper	12,600	6,550	Comp.	Vapor Phase, Kellogg
Standard Oil Co. (Ind.), Greybull	5,000	2,500	C-A	Cross
Star Refinery, Osage	75	.....	S	
Texas Co., Casper	7,000	6,800	C	Holmes-Manley, Pressure Coke
Texas Co., Cody	3,000	1,500	C	Holmes-Manley
Texas Co., Calpet	300	.....	S	
Wheatland Ref. Co., Wheatland	75	.....	S	
Wyoming Gas & Oil Co., Osage	150	.....	S	
Total	46,325	26,650		

Shut Down Refineries in the United States

The following tables list the shutdown refineries in the United States as of March 15. The following abbreviations are used: S—skimming; C—cracking; L—lubricating oils; A—asphalt.

ALABAMA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Coastal Pet. Corp., Mobile	6,000	.....	C	Coastal

ARIZONA

Rio Grande Oil Co., Phoenix	1,000	.....	S	

ARKANSAS

E. M. Tulle Ref., El Dorado	1,000	.....	S	
Houston Oil Co., Camden	3,500	.....	C	Dubbs
Ouachita Valley Ref. Co., El Dorado	2,000	1,500	C	Dubbs
Simms Oil Co., Smackover	3,000	2,000	C	Cross
Union Asphalt Co., El Dorado	2,000	.....	C	Union
Total	11,500	3,500		

CALIFORNIA

East West Ref. Co., Los Angeles	1,000	.....	S	
General Petroleum Corp., Olinda	2,000	.....	S	
Hart Dearing Ref. Co., Fellows	2,500	.....	S	
Hercules Gasoline Co., Los Angeles	5,500	.....	C-A	Jenkins
McCallen, M. M., Ref. & Prod. Co., Huntington Beach	1,200	.....	A	
Orange County Ref. Co., Newport	1,000	.....	S	
Richfield Oil Co., Los Angeles	4,000	.....	S	
Richfield Oil Co., Bakersfield	2,000	.....	S	
Seaside Oil Co., Summerland	500	.....	A	
Signal Oil & Gas Co., Hynes	5,000	.....	T	
Texas Co. (Calif), Coalinga	500	.....	S	
Union Oil Co. of Calif., Avila	10,000	.....	S	
Williamson, Chas. A., Long Beach	500	.....	S	
Wilshire Oil Co., Fellows	2,500	.....	S	
Total	38,200			

COLORADO

Mancos Dome Ref. Co., Mancos Creek	60	.....	S	

ILLINOIS

Barber Asphalt Co., Madison	700	.....	A	
Interocean Ref. Co., McCook	5,000	.....	L	
Socony-Vacuum Oil Co., Inc., (Lubrite) Wood River	4,000	2,500	C	Dubbs
Total	9,700	2,500		

INDIANA

Interstate Gasoline Co., East Chicago	2,500	.....	S	
Portland Oil & Ref. Co., Portland	600	.....	S	
Total	3,100	.....		

IOWA

MonaMotor Oil Co., Council Bluffs	1,500	.....	S	

KANSAS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Grant Oil Co., Augusta	2,500	.....	S	
Richardson Ref. Co., Eldorado	1,500	.....	S	
Tyro Ref. Co., Tyro	30	.....	L	
Total	4,030			

KENTUCKY

Central Prod. & Ref. Co., Bowling Green	600	.....	S	
Great Southern Ref. Co., Lexington	2,500	.....	L	
Neha Ref. Co., Lexington	800	.....	S	
Standard Oil Co. of Ky., Louisville	5,000	.....	C	Burton
Total	8,900	.....		

LOUISIANA

Great Southern Ref. Co., Ardis	2,000	.....	S	
Gupeco Ref. Co., Inc., Alexandria	600	.....	S	
Louisiana Oil Ref. Co., Shreveport	15,000	.....	S	
Red River Ref. Co., Crichton	1,800	.....	S	
Shreveport Ref. Co., Shreveport	500	.....	S	
Sinclair Ref. Co., Meraux	30,000	.....	A	
Williams Refining Co.	400	.....	S	
Total	50,300			

MARYLAND

Interocean Oil Co., Baltimore	7,000	.....	C	Leamon

MICHIGAN

Henry H. Cross Co., Muskegon	1,000	.....	S	
Standard Oil Co. (Ind.), Zilwaukee	1,500	.....	S	
Total	2,500	.....		

MISSISSIPPI

Dixie Oil & Ref. Co., Jackson	1,500	.....	S	

MONTANA

American Ref. Co., Great Falls	1,000	.....	S	
Laurel Oil & Ref. Co., Laurel	5,000	.....	C	Laurel
Montana Ref. Co., Billings	750	.....	S	
Northwest Stellarine Co., Inc., Shelby	1,500	.....	S	
Round Up Oil & Ref. Co., Butte	200	.....	S	
Yale Oil Corp., Miles City	800	.....	S	
Total	9,250			

NEW MEXICO

Bloomfield Oil & Gas Co., Bloomfield	300	.....	S	
State Oil & Ref. Co., Dayton	2,500	.....	S	
Sullivan Refs., Inc., Dayton	1,500	.....	S	
Total	4,300	.....		

OHIO

Allegheny-Arrow Oil Co., Canton	1,500	850	C	Dubbs
Craig Oil Co., Toledo	1,500	.....	L	
Rajah Oil & Ref. Co., Youngstown	500	.....	S	
Total	3,500	850		

OKLAHOMA

Associated Petroleum Co., Allen	8,000	.....	C	Jenkins
Canfield Oil Co., Yale	400	.....	L	
Carter Oil Co., Cartoco	5,000	.....	S	
Century Pet. Co., Tulsa	2,000	.....	S	
Continental Oil Co., Sapulpa	4,000	750	C	Cross
Crescent Ref. Co., Holdenville	1,000	.....	S	
Empire Oil & Ref. Co., Cushing	5,000	.....	S	Doherty
Gem Refining Co., Oklahoma City	1,000	.....	S	
Gilmer Oil Co., Ringling	1,000	.....	S	
Globe Oil & Ref. Co., Blackwell	8,000	4,000	C	Winkler-Koch
Government Ref. Co., Oklahoma City	4,500	.....	S	
Government Ref. Co., Seminole	800	.....	S	
Huckins Ref. Co., Earlsboro	500	.....	S	
Illinois Oil Co., Cushing	3,000	1,500	C	Donnelly
Imperial Ref. Co., Ardmore	4,000	.....	C	Dubbs
Interocean Oil Co., Bristow	3,000	.....	S	
Morgan Pet. Co., Tonkawa	3,000	.....	S	
Peppers Gasoline Co., Covington	1,000	.....	S	
Santa Fe Oil & Ref. Co., Ardmore	5,000	.....	S	
Sinclair Ref. Co., West Tulsa	6,000	3,000	C	Dubbs
Superior Oil Corp., Grandfield	2,000	.....	S	
Walters Ref. Co., Walters	2,500	.....	S	
Yale Oil Corp., Yale	2,000	.....	S	
York Ref. Co., Oklahoma City	2,000	.....	S	
Total	74,700	9,250		

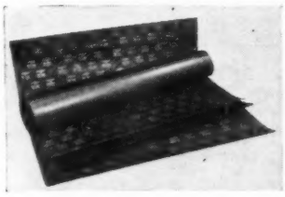
PENNSYLVANIA

Conewango Ref. Co., Langdale Switch	2,000	.....	S	
Island Pet. Co., Neville Island	1,000	.....	L	
North Penn Ref. Co., Tiona	500	.....	L	
Pure-Penn Ref. Co., Clarendon	350	.....	L	
Titusville Oil Works, Titusville	1,000	.....	L-C	Titusville
Valvoline Oil Co., Warren	1,000	.....	Comp.	
Viking Oil Corp., Clarendon	2,000	.....	L	
Waverly Oil Works, Coraopolis	4,000	2,000	C	Cross
Wolverine-Empire Ref. Co., Tidioute	800	.....	S	
Total	12,600	2,000		

(Continued on Next Page)

LINEAR

Linear 182
COMPRESSED SHEET PACKING

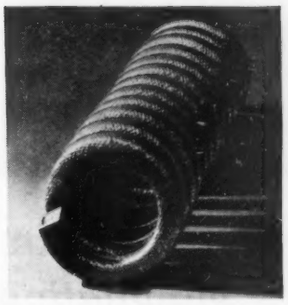


A homogeneous sheet designed particularly for use in the oil industry. Extreme care is taken in selection and preparation of the asbestos fibre and compounding of the sheet to insure strength, uniform thickness and surface finish. Made black throughout, graphited one side.

Linear 170
HOT OIL PACKING

A pure asbestos Hot Oil Packing designed for extreme temperatures; surface graphited. Furnished in coils, reels or rings.

Linear 101
ASBESTOS HIGH PRESSURE PACKING



Handmade throughout of closely woven cloth made of long fibre asbestos yarns. The manner of laying up the center section and applying the heat resisting rubber cushion makes this a resilient, durable and highly serviceable packing.

Linear 192-193
ASBESTOS FOLDED GASKETS

Made of a closely woven asbestos metallic cloth, treated with high heat-resisting compound and folded several plies into required size or shape. Can be used against any pressure on boiler, manhole and handhole covers.

Distributed by

FRICK-REID SUPPLY CORP. PITTSBURGH TULSA

Made by Linear Packing & Rubber Co., Philadelphia, Pa.—Distributors Everywhere.

A PACKING FOR EVERY OIL SERVICE

RUGGED STRENGTH

FOR TOUGH JOBS EDWARD VALVES

There are many excellent reasons for using Edward valves—low upkeep cost, durability, dependability, rugged strength, high value per dollar of cost. Year by year Edward quality is raised in line with more exacting requirements.

Whether you need a non-return valve, blow-off, check, stop, or what will you, there is no better valve than an Edward.

Checking Edward valve seat threads for pitch and form with special "go—not go" gage . . .

Uniform quality is assured by unceasing alertness to detect variations from standard.

The Edward Valve & Manufacturing Co., Inc.
EAST CHICAGO, INDIANA

Picture a man eliminating pipe maintenance costs!

The pipe wrench is losing out to the welder's torch in the piping installation of today. Screwed fittings call for threading—cutting away of effective pipe thickness. Welding takes full advantage of the full pipe thickness. No allowance for threading is necessary. Welding with Taylor Forge Fittings also means smooth-flow interiors.

Yes, it's time to change to welding, and Taylor Forge Seamless Steel Welding Fittings represent this better way at its best. Taylor Welding Fittings are "engineered" to the conditions that long experience and research have indicated. As shown in the illustrations opposite, Taylor Weldells are reinforced at the crotch where stress is greatest, and are provided with tangents which remove the weld from the stresses of the curved section. The principle of selective reinforcement is also carried out in Taylor Tees, and Taylor Welding Fittings are provided with bright, clean, machine-tool bevels which enable the welder to make a sound, dense, penetrating weld.

The Taylor Forge line includes all types of Welding fittings in all pipe sizes and thicknesses. Ask for complete details.

TAYLOR FORGE & PIPE WORKS
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P. O. Box 485.
New York Office,
50 Church St.

It's time to change to Welding!

TAYLOR FORGE
Engineered
WELDING FITTINGS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
TENNESSEE				
Nashville Oil Co., Nashville	500	.....	S	
Urania Pet. Co., Ltd., Memphis	500	.....	S	
Total	1,000	.....		
TEXAS				
Active Oil Corp., Arno	1,500	.....	S	
Adams Ref. Co., Big Sandy	1,000	.....	S	
Allstate Ref. Co., Thrall	2,500	.....	S	
American Ref. Properties, Wichita Falls	5,000	.....	C	Dubbs
Arktex Ref. Co., Kilgore	1,000	.....	S	
Artex Ref. Co. No. 1, Arp	1,600	.....	S	
Artex Ref. Co. No. 2, Longview	3,700	.....	S	
Atlantic Gulf Ref. Co., Kilgore	2,000	.....	S	
Atlas Ref. Co., Gladewater	100	.....	S	
Aviation Ref. Co., Kilgore	200	.....	S	
Bartlett Ref. Co., Kilgore	200	.....	S	
Bluebonnet Oil Ref. Co., Wickett	5,000	.....	S	
Bobrose Oil & Ref. Co., Brownwood	1,000	.....	S	
Bradley Ref. Co., Kilgore	1,200	.....	S	
Calcul Ref. Co., Gladewater	600	.....	S	
Capitol Ref. Co., Luling	2,500	.....	S	
Central Ref. Co., Friars Switch	10,000	.....	S	
Crystal Oil Corp., Burkburnett	1,000	.....	S	
Crystal Ref. Co., Kilgore	1,000	.....	S	
Danciger Oil & Refineries, Inc., Bodie	10,000	.....	S	
East Texas Ref. Co., Henderson	6,000	.....	S	
Empire Oil & Ref. Co., Gainesville	5,000	2,000	C	Dubbs
Ewno Oil Corp., Luling	2,500	.....	S	
Foster & Co., Dennison	600	.....	S	
Four States Ref. Co., Texarkana	700	.....	S	
Freeport Asphalt Co., Freeport	5,000	.....	S-A	
Friars Topping Co., Friars Switch	1,500	.....	S	
Gilmer Ref. Co., Gilmer	500	.....	S	
Godlin Ref. Co., Gladewater	850	.....	S	
Golden West Oil Co., Hondo	150	.....	S	
Goodson Bros. Ref. Co., Gladewater	1,000	.....	S	
Great West Ref. Co., Big Spring	5,000	.....	S	
Gregg Oil Products, Gladewater	500	.....	S	
Henderson Ref. Co., Henderson	12,000	.....	S	
Hunter & Knox Ref. Co., Reeds Switch	100	.....	S	
Ideal Ref. Co., Gladewater	750	.....	S	
Iowa Park Prod. & Ref. Co., Iowa Park	3,000	.....	S	
Johnson Ref. Co., Kilgore	1,400	.....	S	
Keystone Ref. Co., Gladewater	2,300	.....	S	
Kilgore Ref. Co., Kilgore	3,000	1,500	C	Own
Kiltex Ref. Co., Kilgore	500	.....	S	
London Topping & Ref. Co., Overton	400	.....	S	
Macmillan Petroleum Corp., Borger	8,000	.....	S	
Magnolia Pet. Co., Magpetco	10,000	.....	S	
Master Ref. Co., Waco	1,000	.....	S	
Mid-Tex Ref. Co., Midland	2,500	.....	S	
Minerva Ref. Co., Minerva	2,000	.....	S	
Model Oil & Ref. Co., Reeds Switch	1,400	.....	S	
Moon Ref. Co., Graham	600	.....	S	
Motor Fuels Products Co., Laredo	1,500	1,500	C	Jenkins
Nacogdoches Ref., Inc., Nacogdoches	500	.....	L	
Norgold Ref. Co., Olney	1,000	.....	S	
Ocean Ref. Co., Kilgore	3,000	.....	S	
Outdoor Ref. Co., Kilgore	900	.....	S	
Panama Ref. Co., Kilgore	3,500	.....	S	
Pennant Ref. Co., Kilgore	1,300	.....	S	
Pentex Ref. Co., Gladewater	500	.....	S	
Petroleum Conversion Corp, Texas City	300	.....	C	T.V.P.
Phoenix Ref. Co., Dallas	5,000	.....	S	
Pope Ref. Co., Gladewater	1,700	.....	S	
Primrose Ref. Co., Wichita Falls	2,500	.....	S	
Producers Oil & Ref. Co., Kilgore	2,700	.....	S	
Richardson Ref. Co., Big Spring	7,500	.....	C	Jenkins
Rig Topping & Ref. Co., Kilgore	200	.....	S	
Roco Ref. Co., Kilgore	2,400	.....	S	
Rusk Oil & Ref. Co., Overton	4,000	.....	S	
Sabine Ref. Co., Gladewater	500	.....	S	
Samuel, J. Howard, Refinery, Coleman	100	.....	L	
Seymour Ref. Co., Seymour	250	.....	S	
Simms Oil Co., Dallas	4,000	3,200	C	Cross
Southern Oil Ref. Co., Reeds Switch	3,000	.....	S	
Staley, J. I., Refinery, Reeds Switch	6,000	.....	S	
Superior Ref. Co., Tiffin	2,000	.....	S	
Sweetwater Oil & Ref. Co., Sweetwater	1,000	.....	S	
Taxman Ref. Co., Wichita Falls	3,500	1,250	C	Donnelly
Texanna Ref. Co., Kilgore	200	.....	S	
Texas Mexican Oil & Ref. Co., Laredo	800	.....	S	
Texas State Ref. Co. No. 1, Kilgore	4,000	.....	S	
Tonkawa Petroleum Co., Pyote	1,000	.....	S	
Twintex Ref. Co., Kilgore	200	.....	S	
Upshur Ref. Co., Gladewater	1,000	.....	S	
Wabash Ref. Co., Gladewater	1,000	.....	S	
Walrip & Stevens Ref. Co., Omega	1,000	.....	S	
Western Oil Corp., Burkburnett	3,000	.....	S	
West Texas Ref. Co., Pecos	6,000	2,000	C	Donnelly
Wolf Ref. Co., Kilgore	1,000	.....	S	
Young Ref. Co., Archer City	250	.....	S	
Yuba Oil Co., Nacogdoches	200	.....	S	
Total	207,850	11,450		
UTAH				
Diamond Oil Co., Virgin	200	.....	S	

(Continued on Next Page)

WASHINGTON

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Inland Empire Ref. Co., Parkwater	500	.....	S	
Spokane Oil & Ref. Co., Hillyard	1,000	.....	S	
Total	1,500	.....		

WEST VIRGINIA

Tri-State Ref. Co., Kenova	2,500	1,800	C-A	Jenkins

WYOMING

Alliance Oil & Ref. Co., Thermopolis	1,500	.....	S	
Eclipse Oil & Ref. Co., Newcastle	40	.....	S	
Lovell Ref. Co., Lovell	600	.....	S	
Lusk Oil & Ref. Co., Lusk	44	.....	S	
Osage Ref. Co., Osage	1,000	1,000	C	Old Type Cross
Wyoil Ref. Co., Casper	300	.....	S	
Total	3,484	1,000		

Operating Refineries in Canada

Abbreviations: S—skimming; C—cracking; A—asphalt; Comp.—complete, includes all the principal products secured from petroleum.

ALBERTA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Bell Refining Co., Ltd., Calgary	300	.....	S	
British-American Oil Co., Ltd., Coutts	2,500	1,200	C	Dubbs
Imperial Oil, Ltd., Calgary	5,000	3,800	Comp.	Tube & Tank
Lion Refining Co., Calgary	250	.....	S	
Maple Leaf, Ltd., Coutts	5,000	.....	S	
Olsen Refineries, Ltd., South Edmonton	1,000	.....	S	
Regal Petroleum Co., Ltd., Calgary	3,500	.....	S	
Total	17,550	5,000		

BRITISH COLUMBIA

Hi-Way Oil Co., Ltd., South Westminster	600	.....	S	
Home Oil Distributors, Ltd., North Vancouver	1,000	.....	S	
Imperial Oil, Ltd., Ioco	16,000	3,600	Comp.	Tube & Tank
Shell Oil Co. of British Columbia, Ltd., Burnaby (Vancouver)	3,500	.....	S	
Vancouver Oil Co., VanCouver	1,000	.....	S	
Total	22,100	3,600		

MANITOBA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
North Star, Ltd., Winnipeg	500	.....	S	
Radio Refs., Winnipeg	1,000	.....	S	
Total	1,500			

NOVA SCOTIA

Imperial Oil, Ltd., Dartmouth	17,000	6,000	Comp.	Tube & Tank Burton

NORTHWEST TERRITORIES

Imperial Oil, Ltd., Fort Norman	50	.....	S	

ONTARIO

British-American Oil Co., Ltd., Toronto	8,000	3,000	C	Dubbs, Cross
Canadian Oils Cos., Ltd., Petrolia	1,000	(*)	Comp.	
Imperial Oil, Ltd., Sarnia	22,000	14,600	Comp.	Tube & Tank
Lloyd Refineries, Ltd., Port Credit	1,500	700	C	Dubbs
McColl-Frontenac Oil Co., Ltd., Toronto	5,000	3,000	C-L	Jenkins, Gyro
Simrall Ref. Corp., Amherstburg	2,500	.....	S	
Total	40,000	21,300		

*Cracking plant under construction.

QUEBEC

British-American Oil Co., Montreal	15,000	5,000	C	Winkler-Koch
Comet Oil Ref., Ltd., Point-aux-Trembles	3,000	2,000	C	Dubbs
Imperial Oil, Ltd., Montreal	30,000	8,000	Comp.	Tube & Tank
LaSalle Petroleum Co., Montreal	3,000	.....	S	
McColl-Frontenac Oil Co., Ltd., Montreal	12,500	7,500	C-L	Gasoline Products, Jenkins
Shell Oil Co. of Canada, Ltd., Montreal	5,000	3,500	C	Dubbs
Total	68,500	26,000		

SASKATCHEWAN

Imperial Oil Co., Ltd., Regina	6,500	3,300	Comp.	Tube & Tank Burton
British-American Oil Refineries, Ltd., Moose Jaw	4,000	1,500	C	Winkler-Koch
Crow Oil Co., Ltd., Weyburn	300	.....	S	
Excel Refs., Ltd.*	300	.....	S	
Hi-Way Oil Co., Ltd., Regina	200	.....	S	
Karels Oil Refinery, Regina	175	.....	S	
Mutual Oil Refineries, Prince Albert	200	.....	S	
Total	11,675	4,800		

*Plant under construction.

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VALVES-PIPE FITTINGS-FIRE HYDRANTS

Mexican Government Encouraging Growth of Local Refining Industry

By C. O. WILLSON

Operators of refineries in Mexico over the past year, considered as a unit, have increased the crude oil skimming and cracking capacities of their plants. As shown in the accompanying table eight plants have a rated crude oil capacity of 106,300 bbls. daily with cracking facilities totaling 17,000 bbls. daily. A year ago the crude oil capacity was 91,200 bbls. daily and the cracking capacity, 11,500 bbls. daily.

The increase in refining facilities was in line with other trends in Mexican operations which brought increased crude oil production and gains in the demand for petroleum products both domestic and export. The crude oil output of Mexican wells over the past year has averaged 104,500 bbls. daily, a gain of 12 per cent over the year previous. According to data of the Department of National Economy of the Mexican Government the domestic demand for all petroleum products in Mexico last year averaged 45,360 bbls. daily, a gain of 23 per cent over the previous year. Private estimates earlier in the year indicated a smaller percentage gain.

Gasoline Demand Gains

The available figures point to a gain of around 25 per cent in gasoline demand in Mexico over the past year. The completion of improved highways connecting to points in the United States has brought a large increase in tourist travel by automobiles and preparations are now beiag made for a record season in 1935. This has been reflected in increased yields of gasoline at refineries which in turn has necessitated increased cracking facilities.

From information released by government departments and other sources in Mexico, it is possible to summarize Mexican operations. Of the 104,500 bbl. daily crude oil production, approximately 70,000 bbls. daily is being refined at refineries located in Mexico and 32,000 bbls. daily are exported. The remainder presumably is consumed in Mexico as fuel. Exports of all petroleum products averaged 68,000 bbls. daily last year indicating that the exports of refinery totaled 36,000 bbls. daily. Natural gasoline production averaged 630 bbls. daily in 1934, a gain of 23 per cent over 1933. The crude runs to stills of 70,000 bbls. daily represented an increase of 15,000 bbls. or more than 25 per cent over the average runs of the year previous.

In its official reports on refinery operations the Department of National Economy includes as refinery operating oils, all refinery products which have to be rerun or cracked, in determining total throughput. For example a report covering six months of 1934 showed average runs of 102,300 bbls. daily although the actual crude oil runs to stills were approximately 70,000 bbls. daily. The remaining 32,300 bbls. daily represented gas oil and fuel oil for cracking and other products which had to be rerun to secure finished products.

In addition to table 1, three local plants which operate part time refined an average of 300 bbls. of crude oil daily making a total of 70,270 bbls. daily.

TABLE 1—COMPANIES AND PLANT CAPACITIES
(Barrels daily)

Refineries—	Total operations*	Crude oil to stills
Compania Mexicana de Petroleo "El Aguila" S.A.		
Tampico	29,880	25,500
Mexico City	5,800	270
Minatitlan	23,390	23,000
Huasteca Petroleum Co.		
Tampico	35,375	16,000
Pierce Oil Co., S.A.		
Tampico	7,470	5,200
Total	101,915	69,970

*Includes cracking and rerun operations in addition to crude runs to stills.

Products Manufactured

For the entire six months, 18,568,791 bbls. of crude oil and other products were refined at the Mexican refineries. From these operations the following products were obtained: (data in barrels)

Products—	Six months total	Pct. of total
Fuel oil	10,021,014	53.9
Gas oil	1,253,956	6.7
Naphtha	1,523,941	8.2
Gasoline	2,798,528	15.0
Kerosene distillate	325,124	1.7
Kerosene	654,644	3.5
Lubricating oils	193,601	1.1
Crude paraffin	43,691	.23
Refined paraffin	59,868	.32
Asphalt	765,814	4.1
Flux	256,028	1.37
Coke	7,554	.04
Misc. oils	238,498	1.3
Loss	421,524	2.3
Total	18,568,791	

This report indicates the scope of refinery operation in Mexico. A small quantity of crude oil and unfinished oils are imported into Mexico and refined there.

Some of the products listed in the above table are exported to refineries outside the United States and further refined before being made available to consumers. For several years refineries in Mexico finished only those products which were consumed in Mexico. The remainder, consisting largely of tops from the crude oil were exported to refiners in United States and refined into finished products. Over the past four years with the expansion of cracking facilities designed to operate with stocks from Mexican crudes, the trend has been toward more complete operations so that more and more finished products are exported to foreign countries.

Company Operations

Among the individual refining organizations Compania Mexicana de Petroleo "El Aguila" S.A., the Shell representative in Mexico continues to be the largest refiner by a wide margin. The same interests are the largest producers of crude oil and marketers of petroleum products in Mexico. The output of "El Aguila" refineries account for a large part of the petroleum products exported to affiliated companies in foreign countries.

The three refineries of the company located at Minatitlan, Tampico and Mexico City now have a crude oil capacity of 73,000 bbls. daily, an increase of 12,000 bbls. daily over a year ago. The cracking facilities at two refineries consisting of liquid phase and vapor phase units, have a rated charging capacity of 10,500 bbls. daily. The capacity for finished cracked gasoline is given as 5,400 bbls. daily.

The crude and cracking capacities of the Huasteca Petroleum Co.'s refinery located at Tampico have also been increased over the past year. The operation of this refinery has undergone many changes in a modernization program since it was acquired by the Standard Oil Co. (New Jersey) in 1933. The refinery's cracking capacity was increased 1,500 bbls. over the past year.

The Pierce Oil Co. S.A. subsidiary of the Consolidated Oil Corp. has been making steady improvements at its Tampico refinery over the past year. This refinery which does not have cracking facilities, manufactures lubricating oils.

There have been reports that refinery operations in Mexico might be contracted rather than expanded if labor policies supported by the government, continue. Strikes have seriously handicapped the operations of companies not only in the refining end but in all phases of operations over the past year.

Settlements of these strikes through government arbitration, were generally favorable to the employees and as a result there has been a material increase in refinery labor costs over the past year. Unusual provisions in regard to wages, hours of employment, vacations, sick benefits and other phases of employment may weaken the competitive position of Mexican refiners in world markets and in the end work against the best interests of the Mexican petroleum industry.

The plans to develop a Mexican owned refining industry have progressed over the past year but as yet the output of these local refineries is not of general significance. The most ambitious plan is that of Cia de Petroeos de Mexico S.A. commonly known as Petromex. This concern in which the Mexican government has a controlling interest has been selling stock in Mexico. It plans to enter all branches of the oil business in Mexico and it was announced the latter part of 1934 that a refinery would be built in 1935.

PETROLEUM REFINERIES IN MEXICO

Company and location—	Daily Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Jose P. Cavazos et al				
North Laredo, Tamaulipas	*100	.....	S-A	
Cia Mexican de Petroleo S.A.				
Ebano, Vera Cruz	*500	.....	S-A	
Compania Mexican de Petroleo "El Aguila" S.A. (Mexican Eagle Petroleum Co.)				
Tampico, Vera Cruz	35,000	8,000	S-C-A	
Minatitlan, Vera Cruz	33,000	2,500	S-C-A	
Mexico City	5,000	.....	S-A	
Control de Adminstracion de Petroleo Nacional,				
Tampico, Vera Cruz	*500	.....	S-A	
Huasteca Petroleum Co.				
Tampico, Vera Cruz	20,200	6,500	S-C-L-A	Own
Pierce Oil Co. S. A. Tampico	12,000	.....	S-L-W	
Total	106,300	17,000		

*Operating part time. Type of plant: S—Skimming. A—Asphalt. C—Cracking. L—Lubricating oil.

PERSONNEL OF REFINING ORGANIZATIONS IN MEXICO

Cia Mexicana de Petroleo, S.A. Bucareli 35, Mexico City
Representative, W. E. McMahon.
Refinery located in the Ebano Field, Northwest of Panuco and Tamesi River Valleys.

Compania Mexicana de Petroleo, "El Aguilla" S. A. Ave. Juarez, Mexico City.
This company also known as Mexican Eagle Petroleum Co.
Pres., J. A. Assheton.
V. P.s, Luis Riba, F. M. Davies, G. J. Rennow
Secy., P. J. Jonker
Controller, H. F. Garraway
Mgr. Ref. Sales, H. W. Sansom.
Mgr. Tampico refinery, G. G. Roberts
Supt., Minatitlan Refinery, V. Skala
Supt. Mexico City refinery, S. C. Wraight
Domestic Sales Mgr., H. E. Hickman
Ch. Engr., C. J. Crawford
Pur. Agt., A. E. Hagberg
Refineries located at Tampico, Minatitlan and Mexico City

Control de Administracion de Petroleo Nacional, Calle de Colon 41, Mexico City
Management, Mexican government
Small plant at Bella Vista terminal in the Port of Tampico.
Jose P. Cavazos et al, 616 Nuevo Laredo, Tamps.
Privately owned plant located at Nuevo Laredo, Tamps.

Huasteca Petroleum Co., Apartado 9, Tampico, Mexico
V. P. in charge of Mexican operations, L. L. Anderson
Gen. Mgr., G. W. Gordon
Asst. Supt., K. H. Repath
Sales Mgr., H. R. Barbour
Ch. Engr., C. M. Clower
Ch. Chem., D. P. Barnes
Refinery located at Tampico

Pierce Oil Co., S. A., 4/a Calle de Balderas No. 55, Mexico, D. F.
Pres., Gayle S. Steele
V. P., D. D. Freeborn, H. J. Sullivan, S. C. Dysart, W. G. Tschudin.
Exec. Com., A. E. Watts, H. A. Stendrup, K. Porter
Secretary, M. H. Anthoni
Treas., S. C. Dysart
Gen. Mgr., Gayle A. Steele
Refinery Supt., J. L. Welch
Asst. Supt., F. L. Driscoll
Sales Mgr., D. D. Freeborn
Ch. Engr., F. D. Smith
Office Engr., A. C. Figueras
Ch. Chem., A. Silverberg
Mgr. Dist. and Trans. Dept., C. M. Hill
Refinery located at Arbol Grande, Ciudad Madero, Tampico

Application of Calorized Tubes to Refinery Service

(Continued from Page 45)

heads and each tube given 30 passes with sharp bladed knockers. In the case of the plain mild steel tube chips were cut out of the tube wall giving the interior a gouged appearance. On the heavy duty Calorized tube the polish was somewhat reduced but there were no noticeable dents or cuts.

Micrometer measurement of the Calorized tube wall at conclusion of the

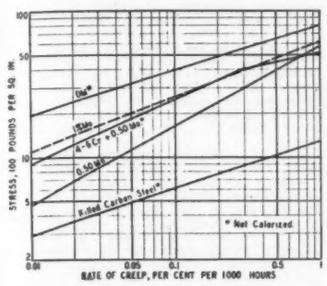


Fig. 5—Creep-stress curves at 1200° F.

cleaner test evidenced no measureable wear. Officials of the refinery stated that the accelerated wear test was equivalent to four years of ordinary cleaning in service.

Following this cleaner test specimens were cut from the Calorized tube and submitted to high temperature oxidation test which demonstrated that there had been no breakdown in the iron-aluminum surface alloy.

It is possible, however, to ruin any tube by allowing the tube cleaners to run in one position for a period of time. It occasionally happens that an operator will leave the tool running for a considerable period while he tends to other business.

Application of Creep Data

In applying creep test data to the design of cracking still tubes it is necessary to examine two conditions—the normal operating temperature and the maximum temperature with excessive coking. Depending upon a variety of factors, principally the type of oil heated, the velocity and the heat input, the tube wall temperature of the tube will start at from 60 to 150° higher than the oil inside and will rise as a lining of coke collects and interferes with the adequate cooling of the tube wall by the oil. Taken from the start to the end of a run the average tube wall temperature may be something like 150° hotter than the oil. We have found the use of the Barlow formula:

$$\frac{\text{O.D. tube} \times \text{pres. sq. in.}}{2} = \text{tube wall stress}$$

to give a satisfactory result in practice. This allows for some inequality of stress across the wall. One school of thought feels that very high stresses are produced by the difference of temperature inside and out. This is true initially but if the stress at the inside is much higher than at the outside, creep will be more rapid until the two have equalized. At these temperatures creep varies about as the third power of stress. It therefore seems apparent that one side of the tube cannot remain permanently more highly stressed than the other. When the tube cools off, however, the outside will be in tension, and the inside in compression when the internal pressure is removed. Practice seems to bear out this theory for the low alloy pearlitic steels which have high conductivity. In the case of austenitic steels, however, there seems to be evidence to the contrary. In that case, the temperature stresses involved would be four or five times greater in the pearlitic steels and may give trouble if the steel goes through a brittle range on cooling.

In the preceding paragraph we have discussed the application of creep stress data to normal temperature design. Usually it will be found that the wall thickness contemplated will be amply strong for that condition. However, due to the fact that the creep strength of all metal falls off rapidly with increased temperature, a relatively short time at

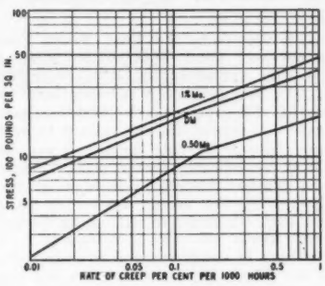


Fig. 6—Creep-stress curves at 1300° F. for indicated steels

100-200° F. above the normal temperature will cause rapid swelling. Usually it is not possible to design a strong enough tube to carry indefinitely at the abnormal maximum temperature which may be attained, but one should ascertain whether the tube selected can carry on for several hundred hours of abnormal operation.

Let us take an example. A tube is to heat heavy oil to 1,000° F., with 20,000-30,000 B.t.u. heat input. Average wall temperature will not be over 1,200° F. Pressure about 500 pounds at point where oil is nearly up to temperature. Tube size: 2½-inch O.D. × ¼-inch wall.

$$\text{Stress} = \frac{\text{2.5-inch} \times \text{500 pounds}}{2 \times \text{¼-inch}} = \text{2,500 pounds per square inch}$$

Reference to the creep stress determination Figure 5 shows that at 1,200° F., only 4-6 per cent Chr. Moly., 1 per cent Moly. Calorized and "DM" have the requisite creep strength to stay below the 1 per cent in 10,000-hour value. But the 4-6 per cent Chrome Moly. does not have sufficient oxidation resistance to maintain the section intact at that temperature, hence we come to the use of the Calorized "DM" or 1 per cent Moly.

Now let us examine the abnormal temperature condition. At 1,300° F., Figure 6, under a load of 2,500 pounds per square inch.

Calorized "DM," creep . . .25%/1,000 hrs.
Calorized 1 per cent Moly., creep . . . . . .18%/1,000 hrs.

Since several per cent total creep before removal is possible, this means that the Calorized tubes of "DM" or 1 per cent Moly. could run thousands of hours at 1,300° F. The 0.50 per cent Moly., however, would not carry the stress at even 1,200° F. since its strength falls off rapidly above 1,100° F. With the small increase in cost and greater superiority of the 1 per cent Moly., and "DM" steels it is believed that these only should be considered.

Should the temperature rise to 1,400° F., however, the life would be limited to several hundred hours. If the temperature does rise to 1,400° F. it will only be rarely and never for long so that both of these tubes could carry on for short intervals at that temperature. At 1,400° F. under this stress a plain steel tube would be scaled and bulged dangerously within 10-20 hours.

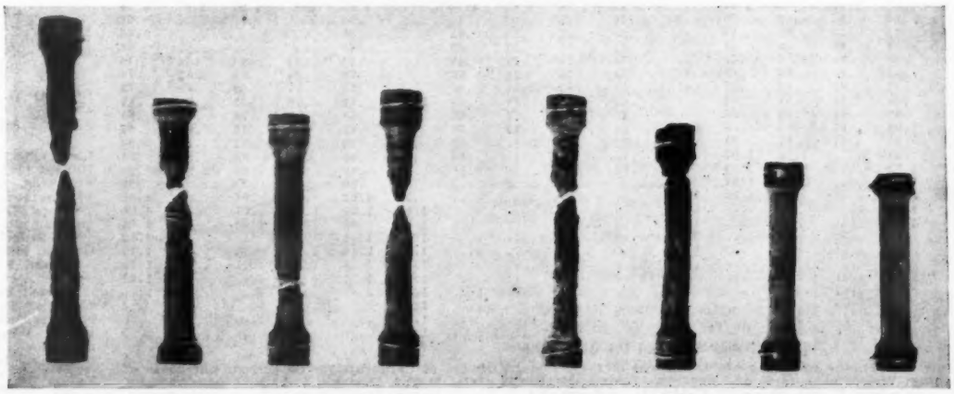
Refinery Applications

Calorized molybdenum and "DM" tubes have not only added to the life of the tube and reduced the yearly maintenance cost in conventional cracking stills but have made possible higher temperature and pressure operations heretofore considered impossible except with the very expensive 18 chromium 8 nickel alloy.

HEAVY DUTY CALORIZED STILL TUBES

CALORIZED Seamless steel tubes render the refiner valuable service in cracking still equipment because of their immunity to the attack of agencies which result in rapid deterioration of plain steel tubing. The iron-aluminum alloy surface is entirely immune to oxidation up to maximum metal temperatures of 1500 degrees F. and is not attacked by high sulphur crude oil. In present-day Heavy Duty Calorizing the surface alloy is tough and thoroughly bonded to the steel, presenting great resistance to erosion and tube cleaner wear.

(LOAD—2000 LBS. PER SQ. IN.)
CREEP SPECIMENS TESTED AT 1400° F.



M. S.	C-Mo.	D. M.	Cr.-Mo.	M. S.	C-Mo.	D. M.	1 Mo.
†Fractured 59 Hr. Elongation 79.4%	†Fractured 110 Hr. Elongation 45.7%	†Fractured 230 Hr. Elongation 21.7%	†Fractured 487 Hr. Elongation 40.1%	Fractured 99.5 Hr. Elongation 41.2%	Fractured 480 Hr. Elongation 15.0%	Not Fractured 600 Hr. Elongation 6.4%	Not Fractured 600 Hr. Elongation 2.24%
UNCALORIZED SPECIMENS				CALORIZED SPECIMENS			

1 MO.=CARBON—MOLBDENUM (1.0 MOLY)
M. S. = MILD STEEL D. M. = TIMKEN D. M. STEEL
C-MO = CARBON-MOLYBDENUM (0.50 MOLY.) Cr.-Mo. = 4.6 PER CENT CHROMIUM PLUS 0.50 MOLY.
†Partly caused by Reduction of Section by Scaling.

Complete details in bulletin:
"High Temperature Creep Values of Low Priced Alloy Still Tubes."
THE CALORIZING COMPANY - PITTSBURGH, PA.

Optimism in Chicago Gasoline Market With Firming of the Tank Car Prices

By SPECIAL CORRESPONDENT

CHICAGO, Mar. 25.—Optimism over the outlook in the gasoline market is unabated here, accompanying a gradual firming up of the tank car prices. Sellers are talking the likelihood of higher spot prices, and they are looking forward to immediately better buying from jobbers. The latter were to be released this week from some of the handicaps placed on their purchases by reason of month-end inventory taxes. Up to this time jobbers have bought gasoline since the present firming started at a somewhat better rate than in earlier months, but their purchases at best have been disappointing.

Effect of major company support in this market is plain to see. While some of the majors appear to be irritated that they are unable to locate as much gasoline at their bid prices as they had expected, bids are being kept in the market. Meanwhile, carlot marketers' purchases are aiding in keeping a firm condition. A good many refiners are now quoting these resellers the same prices for resale that they are quoting jobbers.

Move Heartens Jobbers

The three-tenths cent advance in tank wagon and service station prices throughout the Standard of Indiana territory has been a potent factor in improving the attitude of jobbers. They are not resisting the tank car market advance at this time, as has been the case at times in the past. The general belief is that substantial advances may be expected over the next few months, assuming that reasonable control continues in East Texas.

Gasoline from the East Texas Field is not now much of a factor here. A few cars are struggling into the middle states, but not many offerings are reported. Elsewhere in the Mid-Continent sources of supply are not anxious to push material out at this level and are inclined to hold for better prices. There is a decided interest in gasoline at this time, with the spring season at hand and with consumption expanding seasonally. Roads are not in extremely good condition in the North and in some parts of the South, but more cars are out and gallonage reports show the effects moderately. One leading company operating in this region has been doing considerably better in gallonage east of the Mississippi, compared with comparable periods of 1934, but west of the Mississippi has been experiencing a quite noticeable decline in tank wagon and service station business. Farm conditions are blamed to some extent for this showing.

Better Gasolines in Demand

Better octane gasolines are claiming the interest of the whole trade here now. Much emphasis is being placed on material which can be sold as regular material. The prices are much more nearly in line with Q gasoline prices than in some time. Offerings of this material are quite limited except at substantially higher quotations. The major companies are still keeping the octane rating of their third-grade gasoline comparatively low and concentrating on putting out a high-performance regular house brand. At present prices and differentials retail business reflects the overwhelming preference of motorists for the better material. The unexpectedly large number of new cars being sold is one reason for the interest in good gasolines, it is now generally felt.

Tractor Fuel, Kerosene

Surprisingly large interest is being shown in tractor fuels, as such. Inquiries have been frequent and have involved large gallonage. However, buyers

(Continued on Page 140)

Crude Oil Prices

(Continued from Page 41)

Humble Oil & Refining Co. and Texas Co. Effective September 20 in Salt Flat by Shell Petroleum Corp.

Rocky Mountain States

Iles, light (Sept. 29, 1933)	$.96
Iles, heavy (Sept. 29, 1933)	.90
Florence, Colo. (June 17, 1933)	.80
Fort Collins and Wellington, Colo. (June 17)	(See Salt Creek prices)
Big Muddy (Sept. 29, 1933)	1.01
Frannie, light (May 1, 1934)	.70
Frannie, heavy (Sept. 29, 1933)	.62
Salt Creek and LaBarge (Sept. 29, 1933)	
See Stanolind Mid-Continent price schedule	
Grass Creek, light (Sept. 29, 1933)	1.18
Grass Creek, heavy (Sept. 29, 1933)	.62
Elk Basin (Sept. 29, 1933)	1.18
Rock Creek (Sept. 29, 1933)	1.02
Lance Creek (Dec. 16, 1932)	.92
Hudson (June 2, 1931)	.65
Lost Soldier (Sept. 30, 1933)	.88
Hamilton Dome, all grades (Feb. 16, 1935)	.57
Torchlight (Sept. 29, 1933)	1.18
Greybull (Sept. 29, 1933)	1.18
Pondera (Sept. 29, 1933)	1.25
Sunburst (Sept. 29, 1933)	1.35
Cat Creek, Montana	1.07
Hogback (Sept. 29, 1933)	1.11
Lea County, N. Mex. (Sept. 29, 1933)	.75
Maljamar (Sept. 29, 1933)	.70
Artesia-Jackson (Dec. 1, 1933)*	.75

Note—Salt Creek, Torchlight, Elk Basin, Grass Creek, Frannie, Greybull, Hogback and Iles by Stanolind Oil & Gas Co. Elk Basin, Grass Creek light, Big Muddy, Rock Creek and Sunburst by Ohio Oil Co. Lost Soldier posted by Producers & Refiners Corp. Artesia, Jackson and Maljamar posted by Continental Oil Co. Lea County, effective September 29, 1933, by Humble Oil & Refining Co. and other buyers; Fort Collins, Wellington, Orchard, Florence, Big Muddy, Cat Creek, Rattlesnake and Table Mesa by Continental Oil Co. Osage posted by Arro. Hamilton Dome, Wyo., by Stanolind Oil & Gas Co. Pondera, Mont., by Ohio Oil Co. (Stanolind Oil & Gas Co., effective January 1, 1935, posted $1 per barrel in Pondera.)

*Continental Oil Co.

North Louisiana and Arkansas

Smackover, Ark. (all grades)	$.70
Tullos, Urania, La. (Jan. 13, 1934)	.87
Nevada, Ark. (Sept. 29, 1933)	.60
East El Dorado (Sept. 29, 1933)	.70
Converse, La. (Mar. 17, 1934)	1.03
Elm Grove, La. (Sept. 29, 1933)	.75
Holly, La. (Nov. 17, 1934)	1.03
Pleasant Hill, La. (Mar. 17, 1934)	1.03
Zwolle, La. (Mar. 17, 1934)	1.03
Champagnolle, Ark. (Mar. 17, 1934)	.81
Lisbon, Ark. (Mar. 17, 1934)	1.03
Stephens, Ark. (Sept. 29, 1933)	.70
Urbana, Ark. (Mar. 17, 1934)	.60
Other fields	(See gravity table)

Note—Smackover: Effective September 29, 1933, Texas Co., Magnolia Petroleum Co., Standard of Louisiana, Louisiana Oil Refining Corp., Gulf Refining Co. and Phillips Petroleum Co. East El Dorado posted by Magnolia Petroleum Co. and Gulf Refining Co., Nevada by Standard Oil Co. of Louisiana. Urbana posted by H. L. Hunt, Inc. and Louisiana Oil Refining Co. Converse, Holly, Zwolle and Urbana by Standard Oil Co. of Louisiana; Elm Grove by Simmons Oil & Refining Co.; Pleasant Hill by Standard Oil Co. and Magnolia Petroleum Co. Champagnolle by Standard Oil Co. and Lion Oil & Refining Co.

Eastern States

TIDE WATER PIPE CO.
(Effective Feb. 4, 1935)

Bradford, Pa.	$2.36
Allegany, N. Y.	2.35

SOUTH PENN OIL CO.
(Effective Feb. 4, 1935)

Pennsylvania Grade Oil in National Transit Lines (Bradford Field)	$2.36
Pennsylvania Grade Oil in Southwest Pennsylvania Lines	2.02
Pennsylvania Grade Oil in Eureka Pipe Line lines	1.97
Pennsylvania Grade Oil in Buckeye Pipe Line lines	1.87
Corning Grade Oil in Buckeye Pipe Line Co.'s lines (Oct. 2, 1933)	1.37

PENNZOIL CO.
(Effective Feb. 4, 1935)

Pennsylvania Grade Oil in National Transit Lines:	
Group A (Includes Cochran, Franklin, Hamilton and Doolittle districts.)	$2.27
Group B (Includes Titusville district.)	2.26
Group C (Includes Turkey and Tidioute districts.)	2.25
Group D (Includes Bear Creek and Porkey districts.)	2.24
Group E (Includes Eldeneau, Bull Creek, Rough Run, Carbon, Dipner, Bredin, McJunkin, Jameson, Kennerdell, Emlenton, Tiona, Lacey and Kinzua districts. Price depends on length of pipe line haul to plant at Oil City.	2.21

PURE OIL CO.
(Effective Jan. 4, 1935)

Cabin Creek, W. Va.	$1.83
Bradford Hollow, W. Va.	1.83
Kelly Creek, W. Va.	1.77

CREW-LEVICK CO.
(Effective Jan. 4, 1935)

Oil City-Titusville	2.13

Middle Western States

OHIO OIL CO.

Lima (Feb. 1, 1935)	$1.16
Illinois (Jan. 5, 1934)	1.13
Princeton, Ind. (Jan. 5, 1934)	1.13
Plymouth	Shut in
Western Kentucky (May 26, 1934)	1.03
Midland, Mich. (Sept. 30, 1933)*	1.03
West Branch, Mich.	.86
Oceana, Mich. (Oct. 5, 1933)	.90
Somerset, Ky. (Sept. 30, 1933)	1.23

*Posted by Pure Oil Co. and Simrall Pipe Line Co. Producers Pipe Line Co. pays 5 cents per barrel over Pure Oil Co.'s posted prices. West Branch, Mich., posted by Simrall Pipe Line Co. Somerset, Ky., crude purchased by Ashland Refining Co., Ashland, Ky., and posted price includes premium. Oceana posted by Old Dutch Refining Co. and Naph-Sol Refining Co.

Canada

Ontario (September 9, 1933):	
Petrolia*	$2.10
Oil Springs	2.17
Turner Valley (May 21, 1934):†	
Clear naphtha	$2.55
Discolored naphtha	2.37
Crude oil, 50 gravity	2.19
Crude oil, 45 to 49.9	2.07
Crude oil, 40 to 44.9	1.50

*Imperial Oil, Ltd. †Imperial Oil, Ltd and Regal Oil & Refining Co.

Mexico

Panuco*	$1.01

*F.o.b. ship, based on January transactions and exclusive of production and export taxes and bar dues.

California Crude Oil Prices

STANDARD OIL CO. OF CALIFORNIA
(Effective September 6, 1933)

For current purchases of crude oil at the well (unless otherwise specified). (All gravities above those quoted take highest price offered in that field.)

Gravity—	Long Beach	Seal Beach, Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda, Brea Canyon	Athens-Rosecrans	Torrance	Richfield	Whittier, La Habra	Montebello	Santa Fe Springs	La Habra-Coyote	Midway-Sunset, Elk Hills, Buena Vista Hills	Lost Hills	Coalinga	Coyote
14-14.9	$.65	$.65	$.65	$.65	$.65	$.65	....	$.65	$.65	$.65	$.65	....	$.65	$.57	$.57	$.57	$.65
15-15.9	.65	.65	.69	.69	.66	.69	....	.66	.65	.65	.65	....	.65	....	....	....	.65
16-16.9	.66	.65	.72	.73	.69	.73	....	.69	.67	.68	.65	....	.65	....	....	....	.65
17-17.9	.69	.65	.75	.76	.73	.76	....	.72	.70	.71	.65	....	.68	....	....	....	.68
18-18.9	.72	.65	.78	.80	.76	.79	....	.75	.74	.74	.65	....	.71	.61	.61	.59	.71
19-19.9	.75	.65	.81	.83	.80	.82	....	.78	.78	.78	.65	....	.74	.64	.65	.62	.74
20-20.9	.78	.68	.82	.87	.83	.85	....	.81	.82	.81	.66	....	.78	.67	.69	.65	.78
21-21.9	.81	.72	.86	.90	.87	.88	....	.83	.85	.84	.69	$.72	.81	.70	.73	.68	.81
22-22.9	.84	.76	.89	.94	.90	.92	....	.85	.89	.87	.72	.76	.84	.73	.76	.72	.84
23-23.9	.88	.81	.92	.97	.94	.95	$.83	.89	.92	.90	.76	.79	.87	.77	.79	.75	.87
24-24.9	.91	.85	.95	1.01	.97	.98	.86	.92	.97	.93	.80	.82	.90	.81	.82	.78	.90
25-25.9	.94	.89	.98	....	1.00	1.01	.90	.95	1.00	....	.85	.87	.93	.85	.85	.81	.93
26-26.9	.97	.93	1.01	....	1.04	1.04	.94	.98	1.04	....	.89	.90	.96	.89	.88	....	.96
27-27.9	1.00	.98	1.04	....	....	1.07	.97	....	1.08	....	....	.94	.99	.93	.91	....	.99
28-28.9	1.03	1.02	1.07	....	....	1.10	1.01	....	1.11	....	....	.98	1.02	.97	.94	....	1.02
29-29.9	1.06	1.05	1.09	....	....	....	1.04	....	1.15	....	....	1.01	1.05	1.01	.97	....	1.06
30-30.9	1.09	1.10	1.12	....	....	....	1.08	....	....	....	....	1.05	1.09	1.05	1.00	....	1.09
31-31.9	....	....	....	....	....	....	1.12	....	....	....	....	1.08	1.12	1.09	....	....	1.12
32-32.9	....	....	....	....	....	....	1.15	....	....	....	....	1.12	1.15	1.13	....	....	1.15
33-33.9	....	....	....	....	....	....	....	....	....	....	....	1.16	1.18	1.17	....	....	1.18
34-34.9	....	....	....	....	....	....	....	....	....	....	....	1.19	1.21	....	....	....	1.21
35-35.9	....	....	....	....	....	....	....	....	....	....	....	1.22	....	....	....	....	....
36-36.9	....	....	....	....	....	....	....	....	....	....	....	1.26	....	....	....	....	....
37-37.9	....	....	....	....	....	....	....	....	....	....	....	1.30	....	....	....	....	....
38-38.9	....	....	....	....	....	....	....	....	....	....	....	1.34	....	....	....	....	....

Additional Standard Oil Quotations

Mountain View—Effective July 3, 1934, the following are the prices of the Standard Oil Co. of California for its current purchases of crude oil at the well in the Mountain View Field: 14 to 19.9 degrees, 57 cents; 20-20.9, 58 cents; 21-21.9, 59 cents; 22-22.9, 61 cents; 23-23.9, 63 cents; 24-24.9, 66 cents; 25-25.9, 69 cents; 26-26.9, 72 cents; 27-27.9, 75 cents, 28-28.9, 78 cents; 29-29.9, 81 cents; 30-30.9, 84 cents; 31-31.9, 87 cents; 32-32.9, 90 cents; 33 degrees and above, 93 cents.

Elwood Terrace—F.o.b. ship, 33 degrees, $1.03; 34 degrees, $1.06; 35-35.9, $1.09; 36-36.9, $1.12; 37 degrees and over, $1.15.

Newhall—14 degrees and over, 57 cents.

McKittrick and Kern River—14 degrees and over, 57 cents.

Wheeler Ridge—14 to 17.9 degrees, 57 cents; 18-18.9, 58 cents; 19-19.9, 61 cents; 20-20.9, 64 cents; 21-21.9, 67 cents; 22-22.9, 70 cents; 23-23.9, 73 cents; 24-24.9, 76 cents; 25 degrees and over, 79 cents.

Kettleman Hills—33-33.9 degrees, 93 cents; 34-34.9, 96 cents; 35-35.9, 99 cents; 36-36.9, $1.02; 37-37.9, $1.05; 38-38.9, $1.08; 39 degrees and over, $1.11.

The Texas Co. posted in Shiells Canyon, South Mountain and Santa Paula as follows: 14 to 17.9, 57 cents; 3 cents added for each degree up to and including 26-26.9 degrees at 84 cents; then 4 cents added for each degree up to and including 30 degrees and over at $1. Company posts Standard Oil Co.'s Montebello prices in Montebello and North Whittier, and posts Standard Oil Co. prices in Signal Hill, Alamitos Heights, Huntington Beach, Torrance, Richfield and Santa Fe Springs, all effective September 6.

General Petroleum Co. posts Standard Oil Co. prices in Athens, Rosecrans and Signal Hill; Alamitos Heights up to 26-26.9; Santa Fe Springs up to 35-35.9; Richfield up to 25-25.9; Brea Canyon and Olinda up to 25-25.9, and Torrance up to 25-25.9.

Union Oil Co., effective September 6, posts same price as Standard Oil Co. in all fields in which both purchases, excepting that in Athens-Rosecrans, Union Oil Co. posts 21-21.9, 72 cents; and 33--33.9, $1.18; 34-34.9, $1.21, and 35-35.9, $1.24.

Associated Oil Co., effective September 6, posted same prices for the same grades as Standard Oil Co. of California, excepting that in some fields its gravity scale stops as follows: Huntington Beach, 26 degrees and over; Seal Beach and Alamitos Heights, 36 degrees and over; Coyote Hills, 33 degrees and over; Richfield, 25 degrees and over; Torrance, 25 degrees and over; Inglewood, 24 degrees and over; Santa Fe Springs, 35 degrees and over; Midway-Sunset, Elk Hills, Buena Vista Hills, 30 degrees and over. Also Associated pays 52 cents for oil of 11 to 13.9 gravity in McKittrick, Kern Front, Kern River, Midway-Sunset, Elk Hills, Buena Vista Hills and Coalinga.

Recent Study of Rotary Drilling Fluid Reveals Interesting Characteristics

By JOHN FRANKLIN DODGE[1] and A. C. FRIETSCHE[2]

Drilling fluids or muds are of such vital importance in the drilling of oil wells that they might be termed the "life blood" of the drilling operation. In spite of their recognized importance, there has been relatively little done toward the definite determination of their characteristics, both physical and chemical, and the standardization of instruments and methods of testing.

The particular aim of this paper is to show the results obtained by some of the more recent investigations in the field of mud flow, the behavior of mud under conditions of varying pressure and temperature, and the construction of research instruments to obtain these results.

In this discussion the term "viscosity" will be used in reference to drilling fluids many times, but it is a well-known fact that such a term applies to a mud only in a limited sense, if at all. This misapplication of the word is to be deplored but its misuse has previously been pointed out by Hallan Marsh. Marsh and others have used the word consistency to cover viscosity; plasticity; degree, nature and permanency of dispersion. Stress is placed on viscosity because of its very great importance in the consideration of all drilling problems concerned with mud. While drilling muds may look "thick" or "thin," or "light" or "heavy," the most satisfactory way of settling the question is by a viscosity determination.

The functions of a drilling mud in rotary drilling may be summarized as follows:

1. To remove the cuttings loosened by the bit.

2. To wall up the hole:

(a) To prevent the drilling fluid from penetrating the formation, possibly causing damage to a water or a gas sand exploited in another well, and also to insure the return of the fluid to the surface to allow its reuse.

(b) To consolidate loose sands and thereby prevent sloughing off of walls into the hole.

(c) To seal off minor gas, oil, or water sands.

(d) To form a smooth coating on the sand walls to reduce friction on the drill pipe, and to facilitate the running of casing.

3. In conjunction with No. 2 above, to exert a fluid pressure on the exposed gas, oil or water sands to prevent these sands from blowing out and interfering with the drilling of the well.

4. To hold cuttings in suspension during intervals of suspended circulation while running drill pipe in or out of the hole or while fishing for lost tools.

Practically any mud will perform the functions 1 and 2 and will cover No. 3 fairly well, particularly when weight material is used.

Nos. 2a, b, c, and 4 are very intimately connected with the colloidal properties of the mud used in that the amount of colloidal material will greatly affect the rapidity of the formation of an impervious cake on the wall of the hole, and again, the colloidal content will affect the thixotropic nature of the mud with direct bearing on its ability to form a gel.

A good drilling mud should resemble in consistency a heavy motor oil, with a uniformity of appearance, showing no sharp boundaries between the solid particles and the suspending liquid. After standing overnight there should be little or no free water on the surface, and only traces of sand settled out. There should be a thixotropic gelling action which will be readily reversible allowing a return of the mud to its original liquid state on agitation.

It is recognized today that the most important mud properties are weight or specific gravity and consistency, again calling to mind that the latter term is better known in actual practice as viscosity, and no attempt will be made to limit the terms more closely in the general discussion. The proper density is necessary that sufficient hydrostatic head or pressure may be maintained to overcome any gas pressure encountered, while the viscosity or fluidity governs largely the rate at which the cuttings settle out of the circulating mud, as well as the ease with which the pumps may handle the mud.

Flow of Mud Fluid

Most drilling muds, unless extremely light, on passing through capillary tubes, appear to show characteristics of solids rather than liquids, and exhibit "yield point" and "plasticity" instead of viscosity. This conception is not a new one, having been set forth by March and later by Herrick. These variances may be shown in Figures 1 and 2.

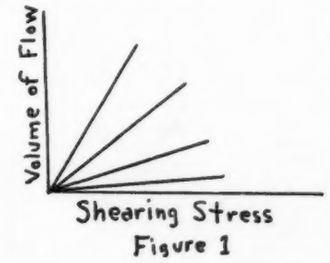


Figure 1

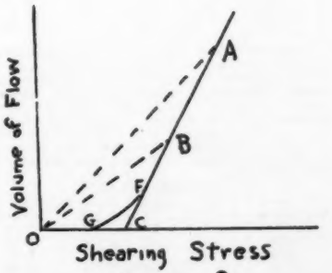


Figure 2

The actual nomenclature may not be of great importance, but from a scientific aspect, the fundamental difference in behavior cannot be ignored. Particularly, it is impossible to disregard the fact that strictly speaking, it is not impossible, by using any instrument or any method, to discover by one observation the plasticity (or viscosity) of a drilling mud that is not a true liquid. This is shown in Figure 2 where it is shown that single observations, based on practice for true liquids might indicate "viscosities" corresponding either to OB or OA.

To discover the yield point and plasticity, we must make at least two observations at different pressures (and even two will suffice only when it is assumed that the straight line law connecting pressure with plastic flow is true.)

Nature of Flow in Rotary Mud Circulation

By many writers drilling muds have been regarded as liquids and the theories of liquid flow applied to them. Such practice is misleading because a drilling mud, as has been mentioned before, more nearly approaches a plastic solid and the following concepts are suggested in the discussion of mud problems:

1. Yield Point. — "Yield value" has been previously used and in liquid flow there is no corresponding phenomenon of measurable value. However, yield point is almost certainly a result of some kind of internal friction, probably of the same type which produces viscosity or plasticity, although the exact mechanism is unknown. In Figure 2 the yield point is shown by the distance from the origin at which the Curve AC intersects the shear axis. It is apparent that a stress equal to the distance OC must be generated before any movement takes place.

2. Plastic Flow.—Plasticity of solids may be regarded roughly as corresponding to viscosity in a liquid. After the yield point has been reached, neglecting slippage, plastic flow resembles viscous flow in that it results from the shearing of one lamina over the lamina next to it.

3. Turbulent Flow. — It is supposed that turbulent flow of some "solids," such as drilling muds can occur if sufficiently high pressure is applied, but no formula has been devised for such flow or its connection with yield point and plasticity.

It is apparent that only theories are possible when such questions are raised as the range of plastic flow and whether or not this range is such that yield point becomes important, and how the rate of any turbulent flow occurring is related to yield point and plasticity determinations in the laboratory. A third question presents itself in the consideration of the flow of thixotropic substances. In a private communication W. E. V. Abraham has advanced the idea that a third form of flow is possible which he refers to as "lubricated" or "plug-like" flow. In this case, after a gel has formed, a much greater force is necessary to start flow than to maintain flow as is shown in Figure 3.

In viscous flow the laminae show differential movement with respect to each other, but, in the case of a thixotropic substance in plug like flow it is entirely possible that a condition as is shown in Figure 4 may exist, in that only enough force is exerted to cause motion as a plug with only slippage at the walls rather than differential movement between lamina. This lubricated flow may pass directly to turbulent flow if the rate of shear is sufficiently increased. A practical demonstration of lubricated flow may be observed by drawing a line with the finger across a mud ditch in which a heavy mud is flowing. At the wall of the ditch the line will remain almost stationary, while the center segment moves slowly down the ditch (Figure 5) showing the center section moving as a plug and exhibiting neither viscous or turbulent flow characteristics.

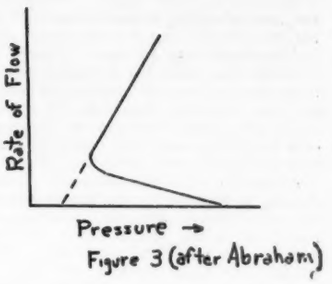


Figure 3 (after Abraham)

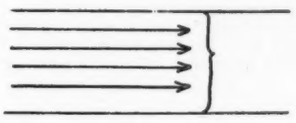


Fig. 4

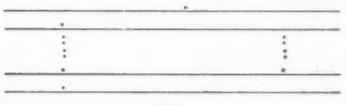


Fig. 5

Following a general discussion of flow characteristics, we may next consider the specific movement of drilling fluids in different parts of the circulating system.

Normally the path of the mud is from the pump, through the rotary hose, down the drill pipe, out through the bit, and up the annular space between the drill pipe and the wall of the hole and into the ditch again.

From a study of pump design it is almost certain that even in the case of very thick muds, the flow in the mud pumps is of the turbulent type due to the pressure exerted and the tortuous passages and orifices through which the mud must pass.

In the rotary hose and the drill pipe movement is complicated by the lack of uniformity of the tube through which the mud passes. Although this is being somewhat changed by the increasing use of full-hole tool joints, it is thought safe to say that the flow in this part of the system is still turbulent.

The rate of flow in the annular space between the drill pipe and the wall of the hole is probably greatly decreased from that in the drill pipe, particularly in the uncased portions of the hole. Theoretical calculations indicate, however, that extremely high viscosities would be necessary to prevent turbulent flow even in this part of the circulation system and the erosive effect produced on tool joints would seem to indicate turbulence at even ordinary circulation rates. Only in the ditch and in the pits does the velocity become low enough during normal operations for the flow to change from turbulent to viscous or perhaps "lubricated flow."

Instruments Used

Many types of instruments have been used in making mud flow and viscosity measurements, and while these will be cited, no attempt will be made to interpret or apply the results obtained, with the exception of the work done by the writers in connection with the pressure and temperature apparatus.

Herrick has utilized the Stormer viscosimeter and a type of apparatus re-

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Before Petroleum Division, A.I.M.E.

Authors' title: "Recent Studies in the Properties of Drilling Fluids."

sembling a modified Engler viscosimeter for mud viscosity measurements. While his results with the Stormer instrument are unsatisfactory in light of more recent practice, with the operation of this instrument, it may be valuable to review his other viscosity apparatus. In this an efflux tube, whose diameter must not exceed 0.05 inch, and which must be measured accurately was used.

A sample of mud, previously passed through a 40-mesh screen, was poured in the viscosimeter and the pressure, in inches of water, under which the test was to be run was established. The stopper was then removed and the rate of discharge in grams per 100 seconds was determined.

The "yield" point and "viscosity" might then be determined from the following formulas:

$$F = 1.3 \frac{D}{L} h \quad (1)$$

$$V = \frac{100{,}000\, D^4}{L\, Q} (H - h) \quad (2)$$

wherefor any point on the line

Q = Grams discharged per second.

D = Diameter of efflux tube in inches (exact).

L = Length of efflux tube in inches (exact).

V = Absolute viscosity in centipoises.

H = Pressure, inches of water, corresponding to rate Q.

h = "Yield point" pressure inches of water.

F = "Yield point," pounds per sq. ft.

Hallan Marsh utilized a funnel viscosimeter as a means of establishing a relative viscosity quickly. This instrument is widely used and consists of a sheet metal funnel 14 inches long from tip to top, with the copper tip or efflux tube 2 inches long drilled accurately to three-sixteenths of an inch.

Five hundred cubic centimeters of mud are poured in and the time of flow for this amount observed by stop watch. From this time in seconds a relative viscosity may be obtained if the funnel has been previously calibrated against a Stormer instrument. While the funnel type viscosimeter is widely used and is good with lighter muds, there is need for the development of a simple but accurate means of determining relative viscosities of all muds.

The Stormer viscosimeter is widely used in the laboratory and has been found adequate for control work by the writers. Because of its widespread use more information concerning methods and results should be available, as well as a standardized method of obtaining and expressing such results.

D. V. Zacher, of the Associated Oil Co., has advocated one method now used, which was also adopted by the Baroid Sales Co. and published in its house organ, "Drilling Mud," September-October, 1932. Under the recommendations of this article it is advised that a uniform rate of shear, 600 r.p.m., be used and the instrument calibrated for this speed using glycerol solutions of known viscosity. In this way the driving weight necessary to bring about a speed of 600 r.p.m. may be plotted against the viscosities of the test solutions and in later tests the absolute viscosities of unknown samples may be read directly from the calibration chart.

Craft and Exner utilized the Stormer instrument in measuring the effect of temperature upon the viscosities of various Gulf Coast drilling muds. In general their work agrees with the results obtained by the writers on California muds, the viscosity of the muds falling as the temperature is raised until 140° F. is reached, at which point the muds start to thicken again.

Effect of High Pressure and Temperature

During 1933 and 1934 work was carried on at the University of Southern California, by the writers, in an attempt to ascertain the effect of high pressures and temperatures on drilling fluids. A description of the equipment used and the results obtained follows.

In approaching the study of viscosity measurements at high pressures and temperatures, no instruments for such a study were found available and it was necessary to design and construct one.

After some preliminary experimentation, a viscometer of the falling ball type was decided upon and was designed and constructed jointly by the authors and the instrument shop of the Union Oil Co. at Santa Fe Springs. The authors particularly wish to acknowledge the valuable assistance of Clarence Frome, general shop superintendent of the Union Oil Co., in this matter.

The completed equipment consists of the viscometer tube and plummets, a pressure gauge graduated from zero to 5,000 pounds per square inch, a circulating pump made by the Elliot Core Drilling Co., of the type used for ejecting cores from core barrels, with a machined plunger using a short stroke which easily produced the desired pressures, an electric hot plate and mud storage tank combined, and a resistance wire heater wound around the tube and insulated by an asbestos jacket.

The tube is 28¾ inches long from the head cover to the foot cover, and that part of the tube through which the plummet falls is 18 inches long. The releasing mechanism in the top chamber is a sliding rod with a collar on it which slips under the small collar on top of the plummet. This rod is activated by a spring, and the action or movement of the rod is controlled by a solenoid catch, which, when current is passed through it releases the rod which in turn moves under the force of the spring and releases the plummet. Two plummets were furnished, the first weighing 962.2 grams with a wall clearance of one-sixteenth of an inch, the second weighing 705 grams with a wall clearance of one-thirty-second of an inch. Both were 4½ inches long. The heavier plummet was used in nearly all of the tests because of the greater wall clearance which was less likely to cause clogging when sandy muds were used.

The electrical contact in the foot chamber is insulated from the tube case and one side of the line is connected to it, while the other side of the line is connected to the case. The mud allows some current to flow and the voltage is measured directly on a voltmeter. When the falling steel plummet makes contact the circuit is completed from the case to the contact and a 150-watt light in the line flashes from a dull glow to full brilliance. The voltage drop causes the voltmeter to fall to zero. In this way the time of fall is visible and is measured to tenths of a second by a stop watch operated manually.

Pressure Tests

Muds of various weights and types were used in the test, in which the pressure was varied and the temperature held constant. Readings were taken in 500-pound steps over the 5,000-pound range. Three readings were taken at each stop, and if these checked within a limit of three-tenths of a second the pressure was moved up. If the readings failed to check within the limit, a minimum of five readings was taken. The average of the readings at each step was taken and the resulting values plotted. The plummet was released electrically and was returned to the top after each fall by inverting the tube.

From these pressure tests a conclusion was reached that for the different types of mud used the variation of pressure produced almost no change in viscosities, as judged from the time of fall of the plummet.

Pressure and Temperature Tests

To facilitate the temperature tests, the viscometer tube was wrapped with heater resistance wire and jacketed with steam pipe insulation, and a thermometer well was inserted in the head cover next to the outlet pipe.

The procedure followed in the temperature tests was slightly changed from that used before. The readings were first taken in steps as the temperature increased and the pressure remained at atmosphere. Later the pressures were varied as the temperature increased, with only the weight of the mud remaining constant. In many cases difficulty was experienced in reaching the higher temperatures, due apparently to the thickening of the mud and formation of steam bubbles in the fluid column. The thickening did not appear to be uniform, there being a tendency for the mud to bake or cling to the sides of the viscometer tube and clog it so that the plummet fell very slowly or not at all.

The results obtained from these tests are given in the following tables:

DATA SHEET 1

Amerada-King No. 2 Mud average time in seconds	Pressure-time runs pressure in lb. sq./in.
6.8	0
5.5	500
5.2	1,000
6.4	1,500
7.0	2,000
7.1	2,500
7.0	3,000
6.5	3,500
6.0	4,000
8.2	4,500
6.4	5,000

The mud used in this test came from the Union Oil Co.'s well No. 2 Amerada-King, in Kettleman Hills. The weight of the fluid was 78 pounds per cubic foot and the room temperature at the time of the test, 71° F.

While no results other than those obtained were expected, due to the slight compressibility of water, the data obtained gave some assurance that accurate results might be obtained from the apparatus.

A suggestion was made that some increase in viscosity might result from increasing pressures because the suspended particles might move together causing a more viscous solution with some "free water" separated out. This view is regarded with disfavor because the water of the mud is only very slightly compressible and transmits pressure in all directions equally, so that instead of a movement of particles nearer to one another there might well be a very slight increase in the distance between them due to their individual compressibility.

DATA SHEET 2

NO. 2 AMERADA-KING MUD—TEMPERATURE-TIME RUNS

TABLE NO. 1

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
0	25	5.10
0	30	3.46
0	35	3.50
0	40	3.26
0	45	3.03
0	50	3.06
0	55	3.00
0	60	3.03
0	65	3.23
0	70	3.67
0	75	4.60
0	80	5.80

Table 1—From No. 2 Amerada-King mud weighing 78 pounds per cubic foot, is an almost perfect example of the behavior of a heavier clay mud at atmospheric pressure with only temperature varying. It will be noted, as in all of the following tables, the shortest time of plummet fall, and therefore by assumption, the points of least viscosity due to temperature effects, lie between 50 and 60° C. With the exception of the second figure on the 30° C. recording all of the figures falling gradually in viscosity from the starting point at room temperature until the above mentioned minimum is reached then a gradual increase as the temperature increased.

TABLE NO. 2

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
0	24	2.20
0	30	2.13
0	35	2.00
0	40	2.00
0	45	1.80
0	50	1.80
0	55	1.86
0	60	....
0	65	1.93
0	70	1.86
0	75	1.93
0	80	1.86

Table 2—Using the No. 2 Amerada-King mud diluted to 72 pounds per cubic foot, is an example of the behavior of a lighter mud under changing temperatures at atmospheric pressure. While the table shows no increase in the higher temperature range, it is believed that it will correspond to the following table, and will show the increase in viscosity found to be a characteristic of teh muds used.

TABLE NO. 3

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
1,000	26	2.50
1,000	30	2.50
1,000	35	2.43
1,000	40	2.30
1,000	45	2.40
1,000	50	2.20
1,000	55	1.80
1,000	60	2.26
1,000	65	2.26
1,000	70	2.26
1,000	75	2.40
1,000	80	2.43
1,000	82.5	2.73

Table 3 was plotted from data obtained from the same mud used in Table 2. While it shows higher viscosity under pressure it is not attributed to the increased pressure but to the redilution of the sample after the previous run to bring the mud to the same weight. The question arises as to whether the colloidal characteristics are the same after heating and dilution, but lack of data prevents an explanation other than the fact that after several of the mud samples were removed from the machine and allowed to dry, they set into a compact cake which resisted efforts to bring the particles back into solution comparable to the original. After the muds were heated they dried much more rapidly than the fresh samples and were prone to ball up when stirred.

This table shows very markedly the point of lowest viscosity at 55° C.

TABLE NO. 4

Pressure lbs./sq. in	Temp. °C.	Time in seconds
1,000	23.5	2.90
1,000	30	2.70
1,000	35	2.70
1,000	40	2.43
1,000	45	2.26
1,000	50	2.40
1,000	55	2.40
1,000	60	2.43
1,000	65	2.60
1,000	70	2.70
1,000	75	2.86
1,000	80	2.86
1,000	85	2.93
1,000	90	3.13

Table 4, while not as regular as Table 1, shows the same general trend. This trend is not nearly so marked because the samples were slightly lighter. The temperatures obtained on this test were the highest of any run. While the low point on this table at 45° C., it will be noted that there is no definite increase in the viscosity until 60° C. is passed.

DATA SHEET 3

NO. 2 AMERADA-KING MUD—TEMPERATURE-TIME RUNS

TABLE NO. 1

Pressure lbs./sq. in	Temp. °C.	Time in seconds
0	23	5.00
0	30	....
0	35	4.40
0	40	3.53
0	45	3.80
0	50	3.00
0	55	3.20
0	60	3.73
0	65	3.70
0	70	3.80
0	75	4.00

TABLE NO. 2

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
1,000	23	5.00
1,000	30	4.13
1,000	35	3.93
1,000	40	3.40
1,000	45	3.26
1,000	50	3.06
1,000	55	3.20
1,000	60	3.60
1,000	65	3.60
1,000	70	4.50
1,000	75	4.00

These tables are related in that they were obtained almost simultaneously. The operating procedure was changed slightly in that the readings were taken at zero gauge pressure and then the pressure was immediately raised to 1,000 pounds where a corresponding temperature reading was taken. In this way a much closer comparison is obtained and the inconveniences of loss of time, loss of moisture from the fluid, and standardization of a comparative sample to coincide with the one used previously are avoided.

The mud used was from the No. 2 Amerada-King sample with a weight of 75 pounds per cubic foot. The times of fall in these tests is much longer than the previous ones, but as this sample had been used previously some of the water had been lost, as is indicated by the increase of weight from 72 to 75 pounds, and therefore greater times of fall or higher viscosities would be expected. The tables follow one another rather closely after the higher temperatures are reached, and their general characteristics correspond to Table 1, Test 2.

Attention is especially directed to the facts that the points on the 1,000-pound table generally are below those on the zero gauge pressure table. While the discrepancy is not attributed to pressure, it illustrates the fact that a pressure increase does not produce a corresponding viscosity change.

DATA SHEET 4

K.N.D.A. MUD—TEMPERATURE-TIME RUNS

TABLE NO. 1

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
0	30	3.93
0	35	2.80
0	40	2.72
0	45	2.54
0	50	2.40
0	55	2.50
0	60	2.50
0	65	2.86
0	70	3.13
0	75	3.66
0	80	....
0	85	7.06

TABLE NO. 2

Pressure lbs./sq. in.	Temp. °C.	Time in seconds
1,000	30	2.46
1,000	35	2.80
1,000	40	2.56
1,000	45	2.40
1,000	50	2.45
1,000	55	2.60
1,000	60	2.70
1,000	65	2.86
1,000	70	3.10
1,000	75	4.00
1,000	80	8.00
1,000	85	....

The mud used in the above tests was from the Kettleman North Dome Association's well, 32-32J, and weighed 79 pounds per cubic foot. A patented weighting material had been added to the native mud. The sample was the heaviest used and was difficult to handle because of pumping difficulties and a tendency to clog the viscometer tube. The procedure used was the same as explained for the two preceeding tables.

These tables indicate the outstanding characteristic of the mud temperature tests. The last point obtained on each test is questionable because only one reading was obtained at each pressure. A more gradual increase in the 75 to 80° C. temperature range might be expected although the actual points obtained are plotted.

The time of fall is longer for this sample because of the greater original weight.

Following this series of experiments the pressure apparatus was abandoned for the time being and attention turned to studies of the effect of temperature alone. A concentric cylinder apparatus of the wire suspension type, similar to the McMichael torsion instrument, has been designed by the writers and is now nearing completion. The plans adopted followed those of Ambrose and Loomis as described in a paper covering work on thixotropic gels. Their apparatus functioned only at room temperature and the chief change in design contemplated is the enclosure of the entire instrument in an oil bath so that close thermal control at high temperatures may be maintained, and the equipping of the instrument with a constant speed motor drive. In this way work may be done upon the sample for any reasonable length of time at any desired temperature within the limits of the oil bath.

At present the principal object of tests with this instrument will be to find, if possible, the changes in viscosity resulting from continued work on a given mud fluid under controlled temperatures.

Conclusions

The studies of the authors to date will seem to justify the following conclusions in reference to drilling fluids:

1. Changes in pressure alone will bring about only a very slight and probably immeasurable variation in viscosity, the variation probably not exceeding the observational error.

2. Temperature changes produce a U-shaped viscosity curve. This conclusion may be modified by the thought that the concentration of the test mud is kept constant only with the greatest difficulty, and the upturn toward the highest temperature end may be due in part to changing concentration due to the loss of the suspending medium. However, from these curves the point of lowest viscosity may be shown to be at, on the average, 55° C.

3. Extremely high temperatures applied to drilling fluids will result in the destruction of the colloidal properties of the mud, and the destruction of the usefulness of the fluid in drilling operations. It is doubtful whether or not bottom hole temperatures reported will bring about this effect, and it is planned to check this point, if possible, by placing a drilling fluid sample in a closed pressure vessel and applying heat coinciding with the highest reported drilling temperature. From this type of test it is thought that some indication of colloidal behavior will result.

Summary

The importance of the viscosity of drilling fluids and its measurement cannot be too strongly stressed. By even an approximate check on the mud as the drilling progresses, valuable information as to the condition of the fluid is easily obtained.

Viscosity control will not only reveal the condition of the mud used, but will also indicate the condition of the hole itself and will assist in obtaining the best possible drilling speed. Savings will be effected in power and the reduction of wear on the pumping equipment because the controlled mud will pump more easily, retain fewer cuttings thus reducing abrasion, and release entrapped gas more readily. The present difficulty surrounding such control is the lack of a standard instrument and standardized procedure to be followed in tests with such an instrument.

Recommendations

In general it is believed that viscosities of muds should be kept as low as possible, always being sure to allow for a reasonable margin of safety, and that the weight and quality of the mud should be frequently checked. A vibrating screen will be of great assistance in removing cuttings and foreign material from the mud as well as aiding in the release of entrapped gas.

Lower viscosities will allow high circulation rates without excessive heads in the hole and straining of the pumping equipment. The full hole tool joints lately developed are of great value in maintaining higher velocities at lower pump pressures.

It is thought by the authors that standard instruments for viscosity, yield value, and plasticity of muds should be adopted and a standardized procedure agreed upon so that the work of various investigators may be correlated and a basis for further progress in research established.

High Vacuum Apparatus for Testing Heavy Oils

(Continued from Page 25)

the heater, the joints sealed and allowed to harden, and the vacuum pump started. The bleed-in jet suitable for the pressure wanted is fitted to the rubber tube on the surge chamber. Care must be taken that particles of dust do not get into the jet or sudden lowering of pressure results. A protector of some kind is advisable.

For distillation at 1 mm. mercury it was usually sufficient with the finest jet to close completely the stop-cock leading to the receiver when the bled-in air enters the system entirely by way of the tee. In this case the pressure in the jar is very nearly that in the receiver.

The heater switch is closed and the rheostat adjusted to produce rapid heating until the insulation begins to feel warm when the amount of heat is reduced considerably. Gradually the refluxing vapors can be seen to appear in the windowed portion of the flask. The temperautre at which the first drop falls into the receiver is recorded, also the 2½-, 5-, 7½-, and 10 per cent points as measured by the volumes in the first test tube. When the 30-cc. mark on the tube is reached the latter is changed for an empty one by the operator contracting a small switch which actuates the electromagnet operating the rack. From this point temperatures are read at every 10 per cent (30 cc.) until it is evident that the maximum temperature is approaching. Then readings are taken at every 1 per cent. The cuts, which can later be analyzed for gravity, viscosity, and other properties, are taken by 10 per cent of the original volume rather than by temperature.

An important point in the operation of the apparatus is so to adjust the amount of heating under the flask that the rate of distillation is constant. A rate of about 2.5 cc. or 60 drops a minute is the usual speed. With a little practice the operator soon learns to adjust the heater rheostat, which must at first be advanced, then slightly retarded as the volume of oil in the flask decreases. The rate of dropping is checked and recorded after each temperature reading. A smooth curve of the boiling-point range cannot be obtained unless the rate of distillation has been maintained fairly constant.

If the distillate becomes waxy or very viscous the condenser is heated by means of the resistance ribbon. Only enough heat to keep the oil fairly thin is needed.

Results

Figure 2 shows distillation curves of a reduced Mid-Continent crude oil at 5 mm. and 1 mm. absolute pressure (curves A and B, respectively) and also the distillation curve of the same oil at 40 mm., using the Bureau of Mines Hempel apparatus (curve C). All the cuts were analyzed by the Bureau of Mines Hempel method and the analyses interpreted[4].

Approximate summaries are shown in Table 1.

In the analyses of crude oils or reduced crudes distillation at very low pressures is valuable in that more of the oil is recovered as distillate. Most refiners are usually concerned with the yield and quality of lubricating distillate that can be obtained from a given crude oil. In the above table it is shown that distillation at 1 mm. pressure discloses the presence of 40 per cent viscous lubricating distillate compared to around 4 per cent at 40 mm. It is evident that analytical distillations at low pressures will enable the refiner better to judge the value of the crude oil, as he can then get a more complete picture of its constituents.

[4] Smith, N. A. C. The Interpretation of Crude Oil Analyses: Report of Investigations 2806, Bureau of Mines, May, 1927, pp. 6-9.

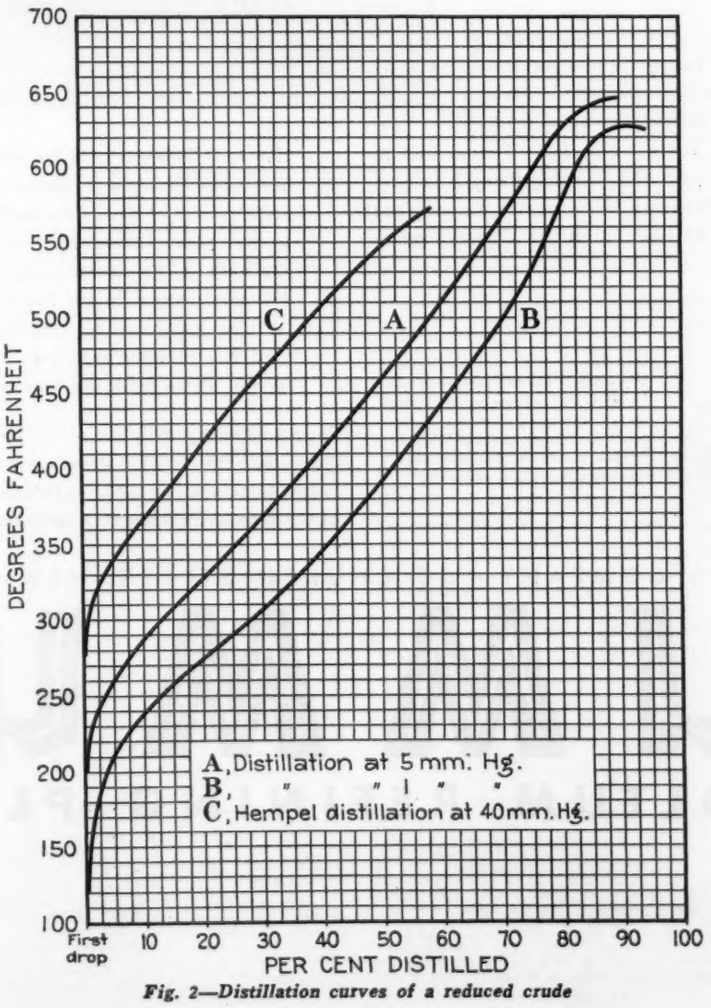


Fig. 2—Distillation curves of a reduced crude

Apparatus Determines Refining Value of Crude

(Continued from Page 47)

operator. Automatic governing valves proved rather irregular in their action, but reliance on hand control has always given satisfactory results.

The rotary vacuum pump is of the oil immersion type, and between it and the unit is interposed a special air dryer, under which conditions the pump gives entirely satisfactory service when driven by a one-fourth horsepower electric motor. The air dryer is covered by a plain ground-glass cover and replenishment of drying material is very easy. In general, all connections throughout the apparatus are by unions and chromium plated piping, with the exception of the joint to the manometer tube.

When working under the steady absolute pressure of 4 mm. of mercury, no difficulty is experienced in obtaining as distillates bright stocks having a viscosity of 200 seconds Redwood at 200° F. in normal laboratory operations and without decomposition being detected in either distillate or residue. The color of these heavy products is exceptionally good owing to the close fractionation obtained with the electrically controlled column. With such a unit it is claimed that distillation can be carried as far as desired, provided that due precautions are taken not to exceed the cracking temperature of the still residue.

The apparatus was developed by Moore & George, Ltd., of London, England.

BRITISH AMERICAN OPERATIONS

TORONTO, Ontario, Mar. 23.—Shareholders of the British-American Oil Co. held their annual meeting here last week, when the directorate was increased from 7 to 10. The former board was re-elected, consisting of G. W. Allan, K. C., Winnipeg; Hon. C. P. Beaubien, Montreal; A. L. Ellsworth, Sir Albert Gooderham and J. Y. Murdock, K. C., Toronto; H. McSweeney, Atlantic City and C. L. Suhr, Oil City, Pa. New directors were P. W. Binns, secretary since 1907; J. C. Miller, treasurer and W. E. Westford, the last-named to retire on the appointment of another western director.

A DISTINCT ADVANCE IN OIL HEATING

The LUMMUS OIL HEATER

To meet the demand for high heat transfer rates in oil heating for distillation and cracking units, Lummus has designed a distinctly new type of oil heater.

Placed in operation two years ago, the first of these Lummus Oil Heaters is running on a topping operation in parallel with a conventional heater of modern design. The same crude, heated from and to the same temperatures, is being charged to both heaters. At the same efficiency, the capacity per square foot of heating surface of the Lummus Heater is 200% that of the conventional heater. Yet, under the same conditions, the maximum absorption rate of any of the heating surface in the Lummus Heater is lower than the maximum absorption rate in the conventional design of heater. Another Lummus Heater has been in operation for nine months in oil cracking service, and a third has recently been installed for the same service. Three more are now under construction.

Have you seen the twelve-page description of The Lummus Oil Heater in the 1934-1935 edition of the Composite Catalog of Oil Refinery Equipment? Additional copies of this description, in the form of a twelve-page technical bulletin, are available.

For a complete description of the Lummus Oil Heater, illustrated with sectional drawings and photographs of installations, see Pages 125 to 136, Composite Catalog of Oil Refinery Equipment. Additional data on request.

THE LUMMUS COMPANY · 50 CHURCH STREET, NEW YORK, N. Y.

LUMMUS

PETROLEUM REFINING PLANTS

East Texas Made 162 Locations During Week; Ninety-nine Wells Completed, 95 Producers

By L. E. BREDBERG

DALLAS, Tex., Mar. 25.—There were 162 locations in the East Texas Field the past week, Sinclair Prairie making 50 locations, and 99 completions, all producers but four, two junked and abandoned, one location abandoned, and one shallow test north of the river dry and abandoned at 730 feet. Two were completed as pumpers, six were completed as "swabbers," one was completed on gas lift, and one was completed as a gasser with a small spray of oil.

There were three wildcat tests abandoned during the week. The test, drilled by Clark & Cowden (formerly Simms Oil Co.), on the Goolsby farm, J. A. McAnulty Survey, Freestone County, 4 miles east of Teague, was dry at 4,428 feet in salt water sand. Woodbine was topped at 4,374 feet, elevation 436 feet. The test, drilled by Brush, formerly Hudson, on the Phillips farm, N. Villareal Survey, Rusk County, was dry at 3,673 feet. Top of Georgetown lime was logged at 3,524 feet. The test drilled by Kelley & Harris on the T. W. Harris farm, William C. Davis Survey, Rusk County, and 2½ miles east of East Texas Field, was dry at 1,500 feet.

Bob Peveto and Howze's No. 1 F. J. Watson, O. Anderson Survey, 1 mile southwest of Tyler, Smith County, coring at 4,958 feet in broken chalk and shale, logged top of Austin chalk 4,749 feet, top of soft Pecan Gap chalk 3,550 feet, hard 3,570 feet.

The Trinity sand test of Tide Water and Texas Seaboard Oil Co., No. 21-A Wills, S. Edmondson Survey, Cayuga Field, northwest Anderson County, is drilling at 6,035 feet in lime.

Amerada Petroleum Corp.'s test on the Burk farm, E. G. Rector Survey, Freestone County, just across the Trinity River from the southwest end of Cayuga Field, was completed at 4,025 feet in sand. The well tested 130 bbls. in 22 hours, tubing pressure 920 pounds, casing pressure 1,250 pounds. First sand was logged at 3,895-3,921 feet, second sand was logged at 4,015 feet, top oil sand 4,019 feet.

Anderson County

Gulf Production Co.'s No. 2 Davey and Royall, M. Rogers Survey, and 50 feet south of No. 1 Davey and Royall gas well, Camp Hill area, Anderson County, was completed for 500,000 feet gas and a little oil at a total depth of 485 feet. Shut-in pressure 80 pounds. Top sand showing oil was logged at 448 feet.

Joe A. Worsham's No. 1 W. F. Wathen, in B. Towels Survey, 1¾ miles north of Cayuga Field, Anderson County, drill stem test 4,060-91 feet, one-half inch choke on bottom in 10 minutes recovered 11 joints of oil and no water with very little gas. Schlumberger test showed salt water sand on bottom, oil sand logged from 4,060-68 feet. If this well makes a commercial producer it will extend the Cayuga Field approximately 1¾ miles north.

The wildcat test of W. C. McGlothlin, being drilled on the M. A. Doboin farm in E. Lowry Survey, 2 miles north of Corsicana, Navarro County, cored 2,147-50 feet and recovered 8 inches of sandy conglomerate and 8 inches of soft brown sand with an odor and saturation. S.L.M. 2,150 feet equals 2,099 feet, in hole for a core from 2,099-2,102 feet but has not been pulled. Showing has caused prices to advance considerably, and it is reported Simms purchased half interest in 475 acres, paying $2,400 cash.

Since discovery, T. J. Wood and others' No. 1 New Birmingham Development Co., in L. Jordan Survey, 7 miles southwest of Rusk, Cherokee County, produced to March 10, 43,160 bbls. The well is now pumping an average of 470 bbls. fluid per day, 63 per cent water.

It is reported J. K. Wells will drill his 3,000-acre block, 2 miles north of LaRue, Henderson County, in the P. Jackson, A. Park, S. W. Mims, Thomas Hanna, N. W. Nugent, B. D. Sublet and E. D. Cowan Surveys.

Humble Oil & Refining Co. is reported to have purchased 1,000 acres east, west and north of Texas Co.'s Bullard block, in T. Quevedo, E. J. DeBard, V. Tejeda and J. Barnhart Surveys, between Bullard and Flint, Smith County.

Gregg County

Amerada Petroleum Corp.'s No. 4 Sheppard, top sand 3,521 feet, total depth 3,551 feet, initial production 30 bbls. in 30 minutes. Arkansas Fuel Co.'s No. C-9 F. K. Lathrop, top sand 3,597 feet, total depth 3,616 feet, initial production 21 bbls. in 15 minutes; No. 7 Ann Lee, top sand 3,607 feet, total depth 3,628 feet, initial production 19 bbls. in 15 minutes; No. 8 L. E. Orms, top sand 3,543 feet, total depth 3,569 feet, initial production 25 bbls. in 15 minutes. Bishop Oil Co.'s No. 7 Richey, top sand 3,567 feet, total depth 3,606 feet, initial production 35 bbls. in 30 minutes. Humble Oil & Refining Co.'s No. 25 Holland, top sand 3,559 feet, total depth 3,585 feet, initial production 125 bbls. an hour. Lechner-Hubbard's No. 6 Harley, top sand 3,545 feet, total depth 3,566 feet, initial production 50 bbls. in 30 minutes. New Process Oil Co.'s No. 6 G. Anderson, top sand 3,487 feet, total depth 3,535 feet, initial production 30 bbls. in 30 minutes. B. F. Phillips' No. B-8 L. P. League, top sand 3,594 feet, total depth 3,602 feet; initial production 25 bbls. in 30 minutes. Rancho Oil Co.'s No. 1-Bx M. Fenn (shallow test), top sand 630 feet, initial production, dry and abandoned. Sinclair-Prairie's No. B-12 Aiken, top sand 3,579 feet, total depth 3,602 feet, initial production 35 bbls. in 15 minutes; No. B-14 Aiken, top sand 3,584 feet, total depth 3,636 feet, initial production 40 bbls. in 15 minutes; No. B-16 Aitken, top sand 3,551 feet, total depth 3,602 feet, initial production 35 bbls. in 15 minutes.

E. L. Smith's No. 1 E. A. Cabinass, top sand 3,578 feet, broken sand and shale, total depth 3,603 feet, in shale, swabbed a little oil, 165 feet in hole, 10 per cent SW, dry and abandoned. Southport-Ruston's No. 1 T. Snoddy, top sand 3,557 feet, total depth 3,572 feet, initial production 90 bbls. per hour. Stanolind and others' No. 10 M. Hays, top sand 3,511 feet, total depth 3,569 feet, initial production 33 bbls. in 30 minutes; No. 11 M. Hays, top sand 3,503 feet, total depth 3,566 feet, initial production 33 bbls. in 30 minutes. Stanolind-Simms' No. 4-AB W. M. Harley, top sand 3,552 feet, total depth 3,632 feet, initial production 20 bbls. in 15 minutes. Sun Oil Co.'s No. 27 Haynie, top sand 3,598 feet, total depth 3,635 feet, initial production 80 bbls. per hour; No. 11 McKinley, top sand 3,625 feet, total depth 3,658 feet, in shale, initial production 40 bbls. per hour.

Texas Co.'s No. 9 G. W. Clark, top sand 3,560 feet, total depth 3,617 feet, initial production 80 bbls. per hour. Barnsdall Oil Co.'s No. 8 D. Smith, top sand 3,567 feet, total depth 3,574 feet, initial production 20 bbls. in 15 minutes. Gulf Production Co.'s No. 27 Alexander, top sand 3,531 feet, total depth 3,560 feet, initial production 78 bbls. per hour; No. 18 M. T. Cole, top sand 3,532 feet, total depth 3,548 feet, initial production 90 bbls. per hour; No. 69 S. Hilburn, top sand 3,565 feet, total depth 3,588 feet, initial production 51 bbls. per hour; No. 12 B. Watson, top sand 3,526 feet, total depth 3,552 feet, initial production 80 bbls. per hour. Invincible Oil Co.'s No. 26 Weiss, top sand 3,610 feet, total depth 3,627 feet, initial production 120 bbls. per hour. Magnolia Petroleum Co.'s No. 5 R. H. Rowland, sand 3,517-81 feet, broken sand, total depth 3,600 feet, initial production pumping 20 bbls. in two hours.

W. H. Matthew's No. 5 L. Martin, top sand 3,735 feet, total depth 3,737 feet, initial production 85 bbls. in 90 minutes. Millford Oil Co.'s No. 4 W. Smith, top sand 3,540 feet, total depth 3,575 feet, initial production 70 bbls. per hour. Overton Refining Co.'s No. 1 King, top sand 3,569 feet, total depth 3,662 feet, initial production 60 bbls. per hour. Pitkins-Goldstein's No. 5 Williams Estate, top sand 3,643 feet, total depth 3,653 feet, initial production 45 bbls. in 30 minutes; No. 52 Watson, top sand 3,532 feet, total depth 3,597 feet, initial production 15 bbls. in 15 minutes.

Tide Water Oil Co.'s No. 21 E. R. Bivens, top sand 3,632 feet, total depth 3,637 feet, initial production 90 bbls. per hour; No. 12 J. M. Blackman, top sand 3,632 feet, total depth 3,639 feet, initial production 90 bbls. per hour; No. 15 J. S. King, top sand 3,560 feet, total depth 3,660 feet, initial production 6 bbls. in 5 minutes. Trans-State Oil Co.'s No. 1 Smith, top sand 3,577 feet, total depth 3,591 feet, initial production 80 bbls. per hour. Weaver-Crim's No. 8 Peterson, top sand 3,606 feet, total depth 3,630 feet, initial production 33 bbls. in 25 minutes.

Rusk County

Agey Drilling Co.'s No. 1 J. Ferguson, top sand 3,622 feet, total depth 3,654 feet, in shale, initial production 20 bbls. in hours. E-Tex Oil Co.'s No. 4 L. Morris, top sand 3,570 feet, total depth 3,602 feet, initial production 65 bbls. an hour. Humble Oil & Refining Co.'s No. B-8 Ben Laird, top sand 3,683 feet, total depth 3,721 feet, initial production junked and abandoned. A. L. Johnson's No. 2 I. R. Irion, top sand 3,810 feet, total depth 3,812 feet, initial production 140 bbls. an hour. Joe Long and others' No. 1 J. Wash, top sand, no sand, total depth 3,676 feet in lime, initial production 6 bbls., dry and abandoned.

C. L. McManah and others' No. 8 J. N. Peterson, top sand 3,640 feet, total depth 3,660 feet, initial production 40 bbls. in 30 minutes. E. H. Moore's No. 4 W. P. Moore, location abandoned. A. L. Plummer's No. 8 Beall, top sand 3,710 feet, total depth 3,712 feet, initial production 90 bbls. an hour. Roberts & Murphy's No. 3 Brightwell, top sand 3,647 feet, total depth 3,674 feet, initial production 75 bbls. an hour. Texas Co.'s No. 5 Chappell, top sand 3,701 feet, total depth 3,705 feet, initial production 90 bbls. an hour.

American Liberty Oil Co.'s No. 2 O. A. Spence, top sand 3,659 feet, total depth 3,680 feet, initial production estimated 5,000,000 feet of gas with a spray of oil. Atlantic Oil Production Co.'s No. 11-A C. Pinkston, top sand 3,668 feet, total depth 3,698 feet, initial production 100 bbls. an hour; No. C-8 Pinkston, top sand 3,585 feet, total depth 3,658 feet in shale, initial production 50 bbls. an hour; No. 9-C Pinkston, top sand 3,580 feet, total depth 3,641 feet, initial production 50 bbls. an hour.

Droppleman Developing Co.'s No. 7 F. J. Cox, top sand 3,693 feet, total depth 3,713 feet, initial production 70 bbls. an hour. R. E. Fair, Inc.'s No. 13 B. F. Maxwell, top sand 3,749 feet, total depth 3,763 feet, initial production 20 bbls. in 30 minutes. Ford-Sample's No. 3 Deason, top sand 3,637 feet, total depth 3,712 feet, initial production 30 bbls. an hour, through 2-inch tubing. Great States Oil Co.'s No. 4 M. Smith, top sand 3,598 feet, total depth 3,632 feet, initial production 30 bbls. an hour, swabbing. Gulf Production Co.'s No. 0-A A. H. Rayford, top sand 3,706 feet, total depth 3,712 feet, initial production 46 bbls. an hour through ¾-inch choke. H. B. W. Oil Co.'s No. 1 M. O. Elliott, top sand 3,510 feet, total depth 3,661 feet, initial production swabbing 50 bbls. in two

East Central Texas Wildcats

Week Ending March 23

ANDERSON COUNTY—CAMP HILL AREA

Gulf Prod.'s No. 1 M. Maddox, David Stitz Sur., 330 ft. out og SE cor. of 120-ac. tract and survey.
Location.

ANDERSON COUNTY

Gulf Prod. Co.'s No. 2 Davey & Royall, 50 ft. S of No. 1, M. Rogers Sur.
T.D. 485 ft.; comp. Mar. 18, 1935; 500,000 ft. gas and little oil; shut-in pressure 80 pounds.

Gulf Prod. Co.'s No. 1 Delaney, in P. Martin Sur., 340 ft. N along E line of Delaney 209.37-ac. tract from SW cor. of Ross' 39.67 acres, and 300 ft. at R/A.
Derrick.

Gulf Prod. Co.'s No. 1 Calloway, P. Martin Sur., 305 ft. from S and 230 ft. from E. Location.

Gulf Prod. Co.'s No. [illegible] L. E. Ross, J. C. Rosson Sur., 330 ft. S and E of 35-ac. tract.
Drlg. 2,903 ft.

Gulf Prod. Co.'s No. [illegible] Flint & Scott, 385 ft. S along E line from NE cor. of 56.75-ac. tract and 330 ft. at R/A.
Location.

Gulf Prod. Co.'s No. 1 O. G. Rogers, 330 ft. out of NW cor. of D. Parker Sur., 5 miles SW of Elkhart.
T.D. 3,014 ft. in shale; mixing mud.

Gulf Prod. Co.'s No. 1 M. J. Ross, 1,770 ft. from SW and 1,370 ft. from NW lines of Robt. Erwin Sur.
T.D. 5,100 ft. in sand and sandy shale; preparing to make drill stem test.

J. W. Lutter' No. 1 C. McKee, 2,640 ft. from N line of lease and survey and 330 ft. from W line of McKey 800-ac. tract.
Derrick.

Tide Water-Seaboard's No. 1 J. Smith, John Adams Sur., 668 ft. W of E line and 467 ft. N of S line of 41-ac. tract (Long Lake area).
Location.

Tide Water Oil Co. et al's No. 21-A Wells, 4,079 ft. N and 2,333 ft. W of lease, S. Edmondson Sur. (Trinity test).
Drlg. 6,035 ft. in lime.

Worsham's No. 1 Wathen, 1,460 ft. S and 467 ft. from E line of B. Towles Sur., NW of Cayuga.
Austin chalk 3,220-3,585 ft.; top sand 4,063 ft.; core 4,062-73 ft.; rec. 1½-inch in sandy shale; 2-inch in ashy sand; core 4,078-89 ft.; rec. 4½-inch; 1 ft. hd. silty shale; T.D. 4,091 ft.; D.S. test 4,060-90 ft.; ½-inch choke on bottom; 11 jts. oil; no wtr.; very little gas; Schlumberger showed S.W. sand on bottom; oil sand 4,060-68 ft.

BOWIE COUNTY

Tex-Ark. Oil Co.'s No. 1 Hamilton Estate, 600 ft. E and 350 ft. N lines, J. Milan Sur., 4 miles S of Red River.
T.D. 250 ft.; W.O.C.

CHEROKEE COUNTY

Jacksonville O. & G. Co.'s No. 1 H. D. Henderson, 660 ft. from N and W lines of 40-ac. tract out of Tankersley 104-ac. tract, 5 miles NE of Jacksonville, J. Pineda Sur.
S.D. 693 ft.

Ponta Oil Co.'s No. 1 C. W. Darby, 1,944 ft. S and 630 ft. W of East Cyrus Parks

(Continued on Page 141)

hours; No. 12 R. Redwine, top sand 3,515 feet, total depth 3,570 feet, initial production swabbing 50 bbls. in two hours. Humble Oil & Refining Co.'s No. 5 J. E. Arnold, top sand 3,654-68 feet, total depth 3,725 feet, in shale, initial production 30 bbls. an hour, gas lift; No. 16 P. R. Guerin, top sand 3,678-3,700 feet, total depth 3,721 feet in shale, initial production 70 bbls. an hour; No. 14 H. S. Piercy, top sand 3,713-28 feet, total depth 3,729 feet in shale, initial production 34 bbls. in 25 minutes; No. 6-C R. E. Silvey, top sand 3,739-55 feet, total depth 3,769 feet, in shale, initial production 85 bbls. an hour.

McMillan and others' No. 3 E. E. Thrash, top sand 3,736 feet, total depth 3,704 feet, initial production 75 bbls. an hour. Marathon Oil Co.'s No. 6 Burton, top sand 3,668 feet, total depth 3,692 feet; initial production 88 bbls. an hour; No. 24 H. C. and H. G. Burton, top sand 3,659 feet, total depth 3,701 feet, initial production 80 bbls. an hour; No. 15 DeGuerin, top sand 3,670 feet, total depth 3,701 feet, initial production 77 bbls. an hour; No. 26 E. E. Moore, top sand 3,615 feet, total depth 3,695 feet, initial production 55 bbls. an hour. Sinclair-Prairie Oil Co.'s No. 16 F. W. Wilson, top sand 3,649 feet, total depth 3,657 feet, initial production 42 bbls. in 15 minutes; No. 19 F. B. Wilson, top sand 3,630 feet, total depth 3,642 feet, initial production 40 bbls. in 15 minutes; No. 10-A J. B. Wilson, top sand 3,630 feet, total depth 3,638 feet, initial production 45 bbls. in 15 minutes. J. C. Oil Co.'s No. 2 W. H. Stroud, top sand 3,540 feet, total depth 3,651 feet, swabbing 20 bbls. an hour.

Smith County

W. B. Hamilton's No. 12 Gambrell, top sand 3,653 feet, total depth 3,663 feet, initial production 181 bbls. in two hours. Hunt Production Co.'s No. 15-B Fair, top sand 3,701 feet, total depth 3,704 feet, initial production 35 bbls. in 17 minutes. Illinois Oil Co.'s No. 19 Mayfield, top sand 3,776 feet, total depth 3,778 feet, initial production 130 bbls. in two hours; No. 26-A Mayfield, top sand 3,804 feet, total depth 3,806 feet, initial production 120 bbls. in 90 minutes. Lane Drilling Co.'s No. 2 D. E. Tyiska, top sand 3,837 feet, total depth 3,839 feet, initial production 70 bbls. an hour.

M. H. McMurray's No. 11 G. A. Turner, top sand 3,801 feet, total depth 3,803 feet, initial production 60 bbls. an hour.

Magnolia Petroleum Co.'s No. 26 I. Wright, top sand 3,655 feet, total depth 3,665 feet, initial production 20 bbls. in 15 minutes. T. C. Reeves, Receiver, No. 10 Wolford, top sand 3,736 feet, total depth 3,741 feet, initial production 210 bbls. in three hours. Sinclair-Prairie Oil Co.'s No. 30-A Mayfield, top sand 3,798 feet, total depth 3,801 feet, initial production 30 bbls. in 15 minutes; No. 7 Moore, top sand 3,728 feet, total depth 3,729 feet, swabbing 58 bbls. in eight hours; No. 9 B. Wilson, top sand 3,751 feet, total depth 3,764 feet, initial production 121 bbls. in seven hours, swabbing. Sun Oil Co.'s No. 5-B J. J. Denton, top sand 3,742 feet, total depth 3,745 feet, initial production 42 bbls. an hour.

Upshur County

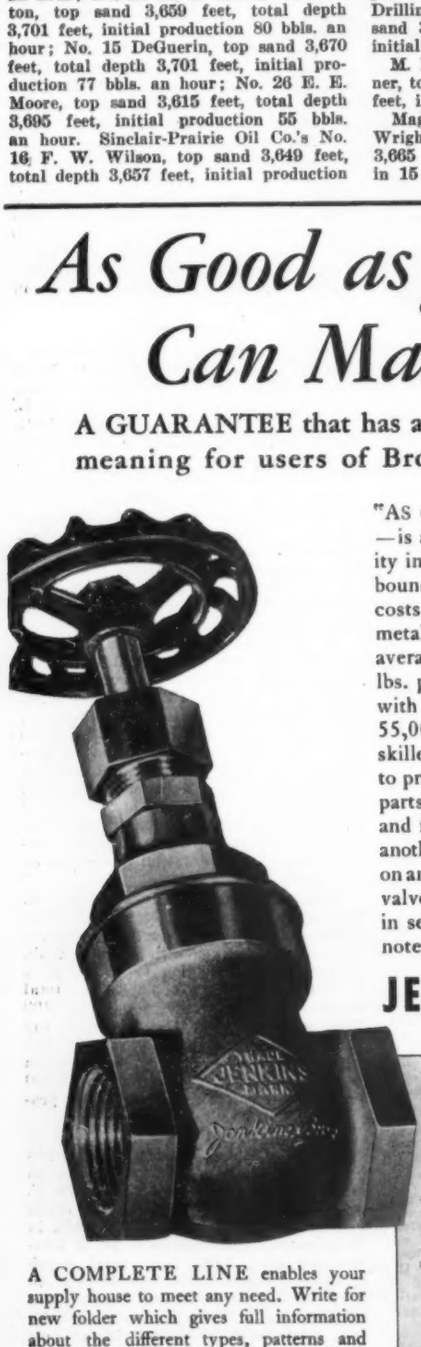
Alma Petroleum Co.'s No. 7 Younce, top sand 3,674 feet, total depth 3,685 feet, initial production 25 bbls. in 30 minutes. Arkansas Drilling Co.'s No. 1 Barrier Bros., top sand 3,653 feet, total depth 3,661 feet, initial production 70 bbls. an hour. Eastern Texas Petroleum Co.'s No. 8 Smith, top sand 3,574 feet, total depth 3,581 feet, initial production 12½ bbls. in 10 minutes. Fla-Tex Co.'s No. 4 Jones, top sand 3,784 feet, total depth 3,785 feet, initial production 25 bbls. in 15 minutes. Margay Oil Co.'s No. 9 Victor, top sand 3,621-26 feet, total depth 3,627 feet, in shale, initial production 24 bbls. in 30 minutes. Mudge Oil Co.'s No. 14 J. W. Free, top sand 3,669 feet, total depth 3,717 feet, initial production 28 bbls. in 12 minutes.

Oils, Inc.,'s No. 15 A. J. Sanders, top sand 3,609 feet, total depth 3,630 feet, initial production 25 bbls. in 15 minutes. Southland & N.&W. Co.'s No. 15 Eva O'Byrne, top sand 3,671 feet, total depth 3,678 feet, initial production 35 bbls. an hour through 1-inch choke.

Southland Drilling Co.'s No. 3 D. S. Shelton, top sand 3,739 feet, total depth 3,743 feet, initial production 55 bbls. an hour. Sun Oil Co.'s No. 5 J. Watkins, top sand 3,668 feet, total depth 3,691 feet, initial production 50 bbls. an hour. C. R. Train Drilling Co.'s (formerly United E.&W.) No. 1-B C. T. Shelton (was United 11-B) top sand 3,708 feet, total depth 3,710 feet, initial production 60 bbls. an hour, through Bryan flow valve. United E.&W.'s No. 4 C. T. Shelton, top sand 3,689 feet, broken, total depth 3,700 feet, initial production 25 bbls. an hour.

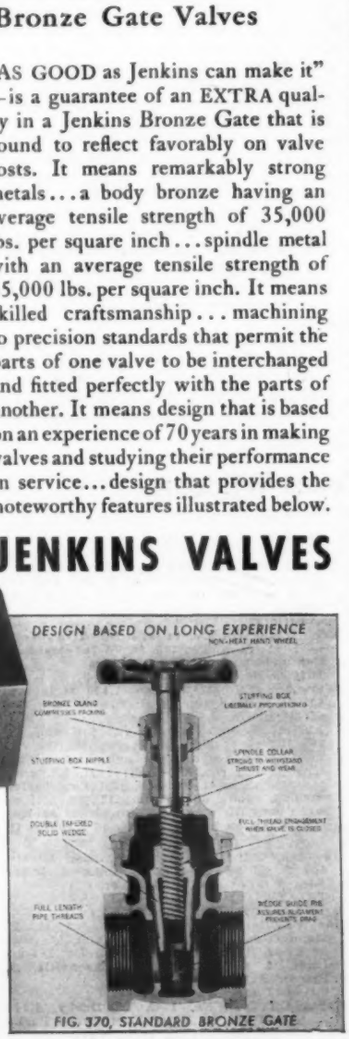
As Good as Jenkins Can Make it

A GUARANTEE that has a dollars-and-cents meaning for users of Bronze Gate Valves



"AS GOOD as Jenkins can make it" —is a guarantee of an EXTRA quality in a Jenkins Bronze Gate that is bound to reflect favorably on valve costs. It means remarkably strong metals... a body bronze having an average tensile strength of 35,000 lbs. per square inch... spindle metal with an average tensile strength of 55,000 lbs. per square inch. It means skilled craftsmanship... machining to precision standards that permit the parts of one valve to be interchanged and fitted perfectly with the parts of another. It means design that is based on an experience of 70 years in making valves and studying their performance in service... design that provides the noteworthy features illustrated below.

JENKINS VALVES


DESIGN BASED ON LONG EXPERIENCE
NON-HEAT HAND WHEEL
BRONZE GLAND COMPRESSES PACKING
STUFFING BOX LIBERALLY PROPORTIONED
STUFFING BOX NIPPLE
SPINDLE COLLAR STRONG TO WITHSTAND THRUST AND WEAR
DOUBLE TAPERED SOLID WEDGE
FULL THREAD ENGAGEMENT WHEN VALVE IS CLOSED
FULL LENGTH PIPE THREADS
WEDGE GUIDE RIB ASSURES ALIGNMENT PREVENTS DRAG
FIG. 370, STANDARD BRONZE GATE

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WASHINGTON NEWS

(Continued from Page 22)

among the nonintegrated refiners, that the posted price of crude oil since the code has, for all practical purposes, been fixed and has not been free to react, as gasoline has done, to the changes in the supply and demand factors and the prospects that have obtained. Despite the fact that price fixing for the industry, as a general policy, was rejected before the date it was to have become effective, and has never since been officially restored, the thought was expressed by many refiners that it was unfair to bring about, by whatever means involved, the practical fixation of the crude price at a level higher than appeared to be warranted by the effectiveness of the production control.

Price of Crude

The refining branch of the industry, the report claims, has been at a disadvantage for a number of years and as a result most of the plans that were doomed by unfavorable location, exhaustion of local crude sources, or inefficiency of operation had already been eliminated prior to the code. Those that are left, in the opinion of the committee, are the cream of the crop in nonintegrated refiners, located at strategic positions and economically and efficiently managed, but they cannot continue in this race of paying the posted price for crude oil and selling their gasoline at the present prices in competition with certain integrated companies with low-cost flush production for which they are realizing, after conversion into gasoline, less than the posted price for crude.

It is the opinion of the committee that most of the integrated companies which post prices for crude have realized the price was too high in relation to the prices of refined products, but since, in most instances, they themselves have not suffered, and in most cases have made considerable money, they have not been inclined to risk disfavor from the administration by cutting the posted price of crude, with the result the refining branch has been obliged to absorb the difference between the posted price and those prices which should have prevailed in a free market.

If gasoline prices do not advance to an approximate parity with crude prices by an early date, the committee says, or if they do not continue in such parity thereafter, then "we recommend an immediate reduction in the price of crude oil to a parity with refined products." The early date mentioned should be about 30 days, the report states.

In shifting the burden from the refiners who buy their crude at posted prices to producers who sell their oil at those prices, and in taking away some of the advantage of the large integrated units who are profiting by the difference between their production costs and posted prices, the committee believes the entire industry would be aroused out of its complacency over the plight of those companies that cannot hold out much longer.

Restoring freedom to the crude prices and making it dependent solely upon the efficacy of control over the supply factions and on the confidence in the permanence of such control would, the committee feels, promote far healthier condition in respect to such control and its improvement than where the price of crude oil is artifically maintained at a level inconsistent with the realities of control and the industry's confidence therein.

Report on Marketing

In the report on marketing the committee finds that local price wars tend to promote monopoly in that they bear more heavily on the smaller, or nonintegrated, units that operate only in the affected areas or only in the marketing branch of the industry, while the larger integrated companies can average their losses over a greater territory or over all the branches of the business.

While the committee is of the opinion price war cannot be entirely eliminated they can be minimized. They point out that usually the ostensible purpose of such war is not accomplished and many of them cannot be explained in any way. The committee does not favor price fixing and, although urged by several complainants to recommend price fixing, declined to do so.

Instead, it is suggested large marketing companies submit formulae, which the committee states the companies should have, which are used by the companies in determining their prices in various areas, to the proper stabilization committee, together with a statement of the reasons for any deviations therefrom which they may make from time to time. Similar information should also be filed by their competitors, while those smaller marketers, who merely follow the markets of leaders in the territory should so state that to be their policy.

To discourage the further building of service stations the committee recommends authority be given to marketers of petroleum products to enter into compacts with each other subject to the approval of the administrator, whereby the building of new service stations, by the parties thereto, or the substantial rebuilding of existing stations, would either be discontinued or restricted in certain agreed upon areas.

It is claimed in the report the smaller companies in the industry do not have the same advance information concerning impending changes in the code and its administration as do some of the large companies with representation of the principal committees. For this reason it is recommended that meetings of the Planning and Coordination Committee and the principal committees under them be open to the trade press.

Dirks Field, Southwest Texas, Defined to South When Test Near Discovery Makes Salt Water

SAN ANTONIO, Tex., Mar. 25.—The new Dirks Field in Bee County was given its first set back, when Navarro Oil Co.'s No. 1 Roth, located south of the discovery, and the record well to be drilled in the field, tested salt water in the Pettus sand at a total depth of 3,914 feet. It topped the Pettus sand at 3,908 feet, and is plugging back to test a sand at 2,800 feet, which showed some possibilities of production. With production defined to the south, considerable attention will be centered on the two tests, to be drilled west and north of the discovery, which will reveal just how large an area this new field is to cover. On the west side of the field, in the J. L. Dugat Survey, Conservative Oil Co. has the derrick up for its No. 1 Harris, and on the north, Dirks Brothers' No. 1 Harris is still a location. The field is located 2 miles northwest of the West Tuleta Field.

Humble Oil & Refining Co.'s No. 2 Thompson, a wildcat test located 13 miles southeast of Beeville, in the William Burke Survey, attracted considerable attention when it showed oil, gas and salt water on three drill stem tests. The first test at 4,850-77 feet showed 425 pounds of working pressure and 30 feet of oily mud in 10 minutes. The second test made from 4,850-84 feet, showed 300 pounds of working pressure and 280 feet of oil sand salt water. A 15-minute test was made from 4,872-84 feet, which tested 800 feet of salt water and oil, of which approximately 40 per cent was oil. The test was made through a one-quarter-inch choke on top, and a five-sixteenths-inch choke on bottom. It is drilling ahead below 4,900 feet.

Seven miles southwest of Beeville Philmont Corp.'s No. 1 J. T. Earnest is a new wildcat test for the county, and is being rigged up. Location is 466 feet west of the southeast corner of the J. C. Madray 216-acre tract in the Sam Allen Survey. Three miles west of Mineral, George Pace and others' No. 1 Goree, Block 26, in the Thomas B. Barton Survey, topped the Pettus sand at 3,730 feet and was abandoned at 4,010 feet.

Caesar Field Active

More activity was assured the Caesar Field, Bee County, when Rual Swiger and others made six locations on the C. A. Gardner 105-acre tract in the Franklin Lewis Survey. No. 2 Gardner, located 150 feet out of the southwest corner, will be drilled first. Caesar Oil & Gas Co.'s No. 1 R. E. Miller, a north offset to Firm Oil Co.'s No. 1 Grissom, in the south end of the field, was abandoned at 3,034 feet.

In the West Tuleta Field, Mills Bennett Production Co.'s No. 3 Roy Harris, northwest side of the field in Section 9, ran considerably lower than the nearest production in that area, and tested salt water in the Pettus sand from 4,037-54 feet. Heyser, Heard & Walton's No. 1-A Walton, in Section 20, was completed in the shallow Cole sand at 3,100 feet and made an estimated 60 bbls. of oil daily. On the east side of the field, Houston Oil Co. was completing its No. 10 Strauss at 3,988 feet, after it showed 3 fourbles of oil and 250 pounds of working pressure on a drill stem test.

Frank Gravis and others' No. 1 Hahl, in the northeast quarter of Survey No. 64, midway between the Government Wells Field and the new Loma Novia Field in Duval County, was tested at a total depth of 2,558 feet, after 7-inch casing had been cemented at 2,554 feet and showed 90 per cent salt water. It will probably be cored deeper to the same level from which production is found in the Loma Novia Field, at approximately 2,750 feet. One mile south of the above test, L. & R. Oil Co.'s No. 1 Hahl, in Survey No. 63, is coring below 2,730 feet. On a drill stem test made last week, it tested dry gas with 400 pounds of working pressure through a three-eighths-inch choke at 2,578 feet, but tested salt water after it had been cored to 2,619 feet.

Sandia Gas Field

In the Sandia gas field, northern Jim Wells County, O. W. Killam's No. 1 W. D. Wade, which showed promise of opening up the first oil production for this field, several weeks ago, was drilled to 4,850 feet and is now plugging back to 4,116 feet, where the hole will be sidetracked, and recored from 4,169-76 feet.

John Camp Drilling Co. is reported to have leased all of the Michael O'Boyle Survey No. 7, in McMullen County, extending south of the Jacobs Pool to the Frio River, a mile or more west of the Calliham Field. The tract includes 1,250 acres. Another tract which was reported purchased was a 1,000-foot strip of acreage on the west side of the E. W. B. Scrugham Survey. Both of the tracts were purchased from Charles T. Lark and others, and contracts for three wells have been let to the Stewart Drilling Co.

Sam Fordyce Field Extended

Another short extension was made at the Sam Fordyce Field, Hidalgo County, by the completion of Skelly Oil Co.'s No. 1 Seabury and others, located in Tract 256, Porcion 38. It made 47 bbls. in 16 hours through a one-eighth-inch tubing choke, with tubing pressure 900 pounds and shut in casing pressure 1,080 pounds. It is bottomed at 2,800 feet and extends the field 700 feet northwest. Navarro Oil Co.'s No. 3 Seabury and others in Tract 256, Porcion 38, which was completed for a wet gas well a few weeks ago at a total depth of 2,770 feet, and then shut in, was opened for another test and the well began making oil. Placed on a production test, it has been making its daily allowable although it continues to have a high gas-oil ratio.

R. H. Vice's No. 1 E. B. Carruth, located 2 miles south of the Barbacoas Pool, in Share 1-B, Porcion 91, showed salt water when tested at 2,895 feet. It is shut down. One and half miles south of the pool, Armstrong and others' No. 1 Starr County Cattle Co., Block 57, Jeffries-Lambeth Subdivision, has apparently extended the field in this direction, showing considerable gas and some oil, after swabbing from sand at 2,705-11 feet.

Balcones Fault Zone Area

In the Balcones Fault Zone area, Bexar County, three wildcat tests were made. Eighteen miles east of San Antonio, Dorine Oil Co. made location for No. 1 S. Tudyk, located in Block 18, in the F. Cardenas Survey. Three miles north of Somerset, the Exploration Co. made location for No. 1 C. M. Harrison, 400 feet from the south line and 200 feet from the west line of the Harrison tract. Carroll C. Raborn staked location for No. 1 McCauley, 150 feet from the north line of Section 52, in the William Harrison Survey, 4 miles south of San Antonio. In the Byersville Field, Williamson County, Coffield and Lanning have made location for their No. 3 Heap, located 200 feet from the north line and 225 feet from the west line of the tract, in the White Survey.

In the Bruni Townsite area, of the West Cole Field, four tests are due to be completed during the week. O. W. Killam's No. 32 Bruni, Block 28, Survey 8, Foltz Subdivision, was bailing after testing a small gas sand at 3,418-29 feet. It will probably be cored deeper. Associated Oil Co.'s No. 2 Bruni, in Survey 7, east of Bruni, cored sand at 3,389-3,405 feet and was testing over the week end. In the same area, Peerless-Seeligson and others' No. 2 Bruni, in Survey 6, showed oil from 3,414-18 feet and the operators are running casing. Sun Oil Co.'s No. 6 Bruni, Survey No. 5, was testing at 3,428 feet after it had been plugged back from 3,433 feet. Highland Oil Co.'s No. 2 Bruni, Survey No. 7, was completed for 30 bbls. per hour at a total depth of 3,408 feet.

In the Pearsall Field, Frior County, the discovery well, Amerada Petroleum Corp.'s No. 3 Halff & Oppenheimer continues to increase in production, and is now flowing under its own pressure 150 bbls. of oil per day, and is reported to be free of salt water. After tubing is run, it is expected to show another increase.

Wildcat Operations in Southwest Texas

Week Ending March 23

ATASCOSA COUNTY

Southwestern Dev. Synd., Ltd.'s No. 1 Tom. 938 ft. from N line, 427 ft. from E line of fence on R.R. right of way, Edward O'Boyle Sur.
Drlg. 400 ft.

BANDERA COUNTY

W. B. Kyle et al's No. 1 Duke, 200 ft. NW line, 150 ft. SW line of J. A. Bennett Sur. No. 7.
Waiting on rig; drlg. wtr. well.

Plateau Oil Co.'s No. 1 Garrison, G.C.&S.F. Sur. No. 506, 1,500 ft. from N and 2,700 ft. from E lines of survey.
Drlg. 2,160 ft.

BASTROP COUNTY

Marts & Beavens' No. 1 Miller, 235 ft. from NE line, 414 ft. from SE line of Blk. 22, Dykes Sur.
T.D. 900 ft.; no report.

BEE COUNTY

Diamond Half Oil Co.'s (H. H. Weinert) No. 1 McKinney, 2,740 ft. from NW line, 330 ft. from NE line of Spenner Morris Sur.
Coring for Pettus 4,000 ft.

Cecil Hagan and Eastland Oil Co.'s No. 1 Fred Schroeder, 5 miles SW of Green.
Moving in material.

Haines-McMillan Oil Corp.'s No. 1 Stoltzfus, 150 ft. from N and E lines of NE¼ NE¼ NW¼ Sec. 14.
Spudded.

Humble O. & R. Co.'s No. 2 Thompson. 466 ft. NW of SE cor. of J. C. Wood tract, Wm. Burke Sur.
Tested 300 ft. S.W. 4,855-84 ft.; reaming for another test; T.D. 4,884 ft.

Jamison, Byron et al's (Dirks) No. 1 P. L. Campbell, Brooks & Burleson Sur.
Drlg. 3,550 ft.

Worth Oil Co.'s No. 1-A Rutledge, 100 ft. S of No. 1, B. Q. Hadley Sur.
Drlg. 2,470 ft.

BEXAR COUNTY

Campbell's No. 1 Cantu, offsetting Meador's No. 1 Cantau, 150 ft. SW line, Arocha Sur. No. 15.
T.D. 1,481 ft.; bailing.

Jones & Kieffer's No. 1 LaGrane, NW cor. of tract, 210 ft. each way, F. Rolen Sur.
Standing 586 ft.

Geo. O'Neil's No. 1 Holly Crouch, NW cor. of 150-ac. tract.
Preparing to set csg. 1,395 ft.

CALDWELL COUNTY

Coffield & Lanning's No. 1 Franks, 150 ft. from N and E lines of S½ of 131.6 acres, Edward Brown Sur.
Ready to spud.

DEWITT COUNTY

S. S. Price et al's No. 1 Beuhrig, 330 ft. from N and E lines of Sec. 7, T.&N.O. Sur.
Rigging up.

DUVAL COUNTY

Buffalo-Texas Syndicate's No. 1 Escobas, 2,777 ft. from N line, 1,944 ft. from W line of 930-ac. tract in San Francisco grant.
S.D. 4,010 ft.

Eckert-Peacock et al's No. 1 C. W. Sutherland, 330 ft. N and W lines of SW¼ NE¼ of Sur. 188, Abd. 2,500 ft.

Intrepid Oil Co.'s No. 1 Parr, 2,590 ft. from S line, 150 ft. from E line, Sec. 26.
Recmtd. for another test, 4,856 ft.

Johnson Bros.' No. 1 Hubbard, 990 ft. out of SW cor. of Sur. 84.
Rigging up.

Henderson & Harvey's No. 1 Chernosky, 330 ft. from S line, 660 ft. from W line, Sur. 226.
Drlg. 1,800 ft.

Pearson et al's (Grimes et al) No. 1 Fitzsimmons, 300 ft. from S line, 150 ft. from E line of Sur. 291.
T.D. 4,552 ft.; P.B. to 4,400 ft.; to whipstock and core again.

EDWARDS COUNTY

Barry Adams' No. 1 Holman, 1,650 ft. N line, 330 ft. from E line, Sec. 22, C.C.S.D.&R.G.N.G. Sur.
S.D. 602 ft.

FAYETTE COUNTY

Clark et al's No. 1 Becker, 750 ft. NW line, 1,300 ft. SW line of 143.74-ac. tract in A. E. Baker League.
Location.

Ross Fenton's No. 1 Kasper (263-ac.). 3,000 ft. from NE line, 1,280 ft. from SW line, of Thos. Green Sur. No. 28.
Location.

FRIO COUNTY

Amerada Pet. Corp.'s No. 1 Davies, 1,320 ft. from NW line, 330 ft. from NE line of B. L. Crouch Sur.
Moving in material.

Amerada Pet. Corp.'s No. 3 Halff & Oppenheimer, 2,100 ft. from southwesterly NW line, 300 ft. NE line of B. J. Gilman Sur. No. 16.
T.D. 3,936 ft.; flowing 150 bbls. per day; running tubing to complete.

W. T. Shoemaker's No. 1 M. Roche, 150 ft. SW cor. of Carl Wenzel Sur. No. 139.
Drlg. shale 2,450 ft.

GILLESPIE COUNTY

Ed L. Nixon's No. 3 Lindig, 12,694 ft. S line, 1,333 ft. W line, Maria Josepha Guerra Sur. No. 41.
S.D. in lime 692 ft.

GONZALES COUNTY

Southwestern Dev. Co.'s No. 1 W. S. Atkinson, 2,054 ft. from N line, 1,034 ft. from

(Continued on Page 142)

ROCKY MOUNTAIN RUNS

Estimated daily average crude oil production for the week ending March 23, follows:

	Bbls.
WYOMING	
Salt Creek	17,860
Big Muddy	1,720
Badger Basin	40
Black Mountain	140
Byron	340
Dallas Derby	630
Dutton Creek	60
Elk Basin	shut in
Ferris	20
Frannie	10
Garland	1,140
Grass Creek	shut in
Hamilton Dome	1,510
Hudson	270
LaBarge	1,200
Lance Creek	640
Lost Soldier	1,710
Mule Creek	shut in
Midway	80
Notches	shut in
Oregon Basin	3,520
Osage	610
Pilot Butte	30
Rock River	1,400
Poison Spider	50
Teapot	20
Total Wyoming	33,000
MONTANA	
Buckley-Border	270
Cat Creek	750
Cut Bank	4,750
Dry Creek	30
Kevin-Sunburst	3,630
Lake Basin	50
Pondera	830
Total Montana	10,310
COLORADO	
Florence	210
Fort Collins and Wellington	450
Iles Dome	3,510
Moffat	440
Orchard	80
Rangely	90
Tow Creek	180
Total Colorado	4,970
NEW MEXICO	
Artesia	580
Cooper area	3,010
Eunice area	4,360
Hobbs	31,450
Hogback	200
Jal	3,380
Lea area	1,410
Maljamar	1,830
Rattlesnake	740
Table Mesa	80
Total New Mexico	47,040
Total Rocky Mountain region	95,320

Mile West Extension of Denman Pool Starts Play; New Lime Pay Zone Opened in Electra Field

By L. E. BREDBERG
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Mar. 25.—West Texas activity was headlined by finding commercial production in a mile west extension to the Denman Pool, Howard County, which will call for considerable drilling in the area. Dorn and Bennett's No. 1 Read, in the SE cor. Section 45, Block 30, Township 1n, T.&P. Survey, struck top of the pay at 2,580 feet with increase at 2,635 feet and it is flowing at the rate of 400 bbls. daily while drilling.

This new producer will cause the immediate drilling of three offset wells by three separate operators. The east offset location has already been staked by Iron Mountain Oil Co. in SW cor. Section 46, Block 30, and material will be moved in at once. Iron Mountain owns the W half SW Section 46, as well as the entire southeast quarter of the section, on which it completed No. 1 Read several months ago as an important extension northwest of the Denman Field. Dorn and Bennett's new well is 1 mile due west. Sinclair Prairie hold the diagonal southeast offset tract to the new Dorn and Bennett producer and will probably drill.

If Wooten & Ellis Production Co.'s No. 1 Read, a wildcat in this trend, Section 41, Block 30, Township 1n, T.&P. Survey, is completed as a producer, it will bring considerable more acreage into the proven limits of the Denman area.

Fuhrman Pool

Another producer of interest completed in West Texas last week was Fuhrman Petroleum Corp.'s No. 2-B Boner, in Section 25, Block A-43, P.S.L. Survey, Fuhrman Pool of Andrews County. When first brought in at total depth of 4,410 feet it made 100 bbls. the first hour and flowed 400 bbls. the next seven hours before shutting in. This is the biggest well found in this area and will cause operators to take greater interest in this field which heretofore had been lightly regarded. First big oil was found in this test at 4,406 feet with increase to total depth.

Humble Pipe Line Co. is extending its line from North Cowden Field area in Ector County to the Means area in northern Andrews County to supply an outlet for the latter field. It will also serve the area recently opened by Honolulu and Llano's No. 1 J. E. Parker in Section 7, Block 44, P.S.L. Survey. No. 1 Parker pumped 150 bbls. first 24 hours after being shut in for several weeks and will probably settle to around 75 bbls. per day on the pump. Honolulu and Llano are rigging up for a second test in this area, No. 1-B Parker, about half a mile southwest of the discovery and will spud in in a few days. It is in Section 11, Block A-43, P.S.L. Survey.

Passes 12,000 Feet

The world's deepest test, Gulf Production Co.'s No. 103 McElroy, in western Upton County, has passed the 12,000-foot mark and is going ahead at 12,038 feet. The formation has softened considerably lately and it has been making fast time for the past few days. Formation at total depth is gray lime.

Ward County

Two exceptionally good wells were completed in Ward County during the week. Gulf Production Co.'s No. 39 Hutchings, in Section 3, Block F, G.M. M.B.&A. Survey, was brought in flowing at the rate of 30 bbls. per hour with 324,000 feet of gas from total depth 2,-613 feet; and Westbrook & Cayton's No. 5 Bennett, in Section 16, Block 34, H.& T.C. Survey, flowed 1,250 bbls. per day on proration test from total depth of 2,530 feet. In the latter well, one of the largest completed in the area, pay was topped at 2,330 feet with increase to total depth and best pay from 2,512-30 feet. Ward County is still West Texas' most active county with 40 wells on the drilling report.

Dawson County

Dawson County's wildcat, Ray Albaugh and others' No. 1 John Robinson, in Section 46, Block M, E.L.R.R. Survey, is drilling in broken lime at 4,560 feet. Elevation is 3,078 feet and it topped the brown lime section at 4,257 feet.

Another interesting wildcat is Humble Oil & Refining Co.'s No. 1 Pollock, Ordovician test in Section 4, Block M, which is now drilling in anhydrite at 3,-475 feet.

In Sterling County, Darby Oil Co. and Merry Brothers & Perrini's No. 1 Stansberry, Section 20, Block 30, W.&N.W. Survey, is drilling at 2,885 feet in lime and there is still some water in the hole. The 6⅝-inch casing was set at 2,835 feet.

Ector County

Ector County, one of the most active in West Texas during the past few years, now has 26 wells drilling or ready to spud, including several important wildcats and extensions. Most interesting of Ector County's wildcat tests are Gulf Production Co.'s No. 1 Goldsmith, in Section 10, Block 45, Township 1s, T.& P. Survey, which is drilling below 1,900 feet; International Petroleum Co.'s No. 1 E. F. Cowden, in Section 25, Block 44, Township 2s, T.&P. Survey, in the Broderick and Calvert area, which is drilling just below 3,600 feet in anhydrite with the hole caving badly; N. G. Penrose and others' No. 1 Kloh, in Section 31, Block 45, Township 1s, T.&P. Survey, 13 miles northwest of the Judkins area, drilling at 3,525 feet in anhydrite; Landreth Production Co.'s No. 1 Cowden heirs, in Section 18, Block 44, Township 1n, T.&P. Survey, just northeast of Landreth's No. 1 C. Scharbauer, which is drilling around 1,100 feet in red rock; and Empire's No. 1 Cummins, in Section 10, Block 45, Township 1n, T.&P. Survey, three-quarters of a mile southeast and in the same section as Red Davidson's producer. It is underreaming casing with total depth 860 feet.

Considerable activity is centered around the Judkins Pool and the pool was extended southwest recently by George Farley and Continental's No. 1 Connell, in Section 11, Block B-16, P.S. L. Survey, which flowed 100 bbls. in 12 hours following a shot in the lime at 3,482-3,668 feet. North end of the field is active with four wells now drilling and about a mile northwest of production Phillips Petroleum Co.'s No. 1 Scharbauer & Edison, in Section 16, Block B-15, P.S.L. Survey, last reported drilling at 3,960 feet in lime, no oil shows reported although it had 250,000 feet of gas from 3,494-3,502 feet.

Addis Field

At north end of the Addis Field, Stanolind Oil & Gas Co.'s No. 5 E. F. Cowden has been plugged after pumping for several days with recovery of only a few barrels of fluid. In this area, Stanolind's No. 6 E. F. Cowden was reshot and is now cleaning out. Total depth is 4,050 feet and prospect of it making a producer are considered light.

Southeast of the North Cowden Field, Atlantic Oil Production Co.'s No. 1 T. P. Land Trust, in Section 11, Block 43, Township 2s, T.&P. Survey, is still cleaning out and testing after plugging back to 4,300 feet from 4,391 feet. There is still 2,000 feet of water with very little oil in the hole which cannot be bailed down.

East of Hendricks

East of the Hendricks Field and south of Kermit, Maxwell-Atlantic's No. 1 Clapp, Section 37, Block 26, P.S.L. Survey, is plugging to abandon after failing to produce following acid treatment in the lime. Total depth was originally 3,-487 feet where it had flowing sulphur water, but it was plugged back to 3,210 feet. The trend southeast from the Sayre Pool, northeast of the Hendricks Pool, to the Halley producer southeast of the field, continues active and several wells are scheduled to be drilled this year.

Roy A. Westbrook recently purchased 80 acres in the Sayre Pool, paying $16,-000 cash, with obligation to drill a well and a straight one-sixteenth over-riding interest retained by the L. C. Turman estate, from which it was purchased. This tract is the W half SE Section 11, Block B-26, P.S.L. Survey. This tract adjoins the 80-acre lease of Maxwell-Atlantic on the west.

Brewster County

A shallow oil showing was encountered in S. G. Smith and others' No. 1 Ed Decie, in Section 7, Block 1, G.C.R.R. Survey, east of Lenox in Brewster County. It is showing oil through 300 feet of drilling water with total depth 805 feet in lime. Operators had been carrying between 200 and 300 feet of water in the hole while drilling. Last string of pipe was set at 775 feet.

Glasscock County

John I. Moore and others' No. 1 McDowell, deep test in Section 22, Block 34, Township 2s, T.&P. Survey, north central part of Glasscock County, continues drilling and at last report was below 9,590 feet in brown and gray lime. It had an increase in gas at 9,560 feet and a slight increase in oil at 9,580 feet. The oil is light green in color.

John I. Moore and others' No. 2 McDowell, in Section 21, about a mile east of the deep test, and south offset to World Oil Co.'s No. 3 McDowell, is drilling ahead 1,980 feet in red shale.

There were 12 new locations in West Texas last week, a decline of about 8 from the previous week. Twelve new producers were added with a total initial production of around 2,800 bbls. daily. Three wells were plugged and abandoned.

NORTH CENTRAL TEXAS

Opening of a new lime pay zone in the Electra Field of Wichita County featured this week's development in the North Texas district. This new lime horizon was found by Continental Oil Co.'s No. 4 L. P. Douglas, in the D.L.&C. Survey, which has been producing for more than a decade in the regular sand pay zone from 1,541-62 feet. It was deepened and picked up the lime from 1,925½-34 feet. This section was acidized and the well came in swabbing and flowing at the rate of 50 bbls. per hour with increase in the flow as the well was cleaned out. The last two-hour period before shutting in on account of lack of storage it produced 150 bbls. This is the first well to be deepened to the lime in this area and a well of this size will naturally stimulate activity in the area. Many operators have already made plans to deepen their wells to this new pay.

Another test in Wichita County which is showing for production at a much greater depth is Hammond Oil Co.'s No. 1 J. C. Straus in Block 22 of K.M.V.L. Survey. It encountered pay from 3,870-75 feet and operators are planning to shoot and then acidize to get maximum production. After encountering the pay oil rose 2,000 feet in the hole in just a few hours.

A new deep sand was found in Cooke County by Petroleum Producers' No. 6 G. W. Andrews, north of Muenster. This test, in an area where wells are producing from a lime pay around 1,260 feet, failed to make a well in that zone and was carried deeper. At 1,385 feet it

Wildcat Operations in West Texas

Week Ended March 25

ANDREWS COUNTY

Fuhrman Pet. Corp.'s No. 2-B Boner, 440 ft. from N and 1,320 ft. from E, Sec. 25, Blk. A-43.
Drlg. 4,406 ft., lime; increase oil 4,312-4,319 ft.; flowed 500 bbls. oil in 8 hrs.

Honolulu & Llano Oil Co.'s No. 1-B Parker, 440 ft. from N and 1,650 ft. from E, Sec. 11, Blk. A-43.
Rigging up.

Humble Oil & Ref. Co.'s No. 3 Means, 1,980 ft. from S and 3,300 ft. from W, Sec. 4, Blk. C-45.
T.P. 4,140 ft.; T.D. 4,628 ft., lime; flows average 16 bbsl. oil per hour when agitated.

Humble Oil & Ref. Co.'s No. 2 Means, 660 ft. from N and 1,997 ft. from E, Sec. 9, Blk. A135.
Drlg. 3,792 ft., anhydrite.

Humble Oil & Ref. Co.'s No. 4 Means, 654 ft. from S and 1,997 ft. from W, Sec. 4, Blk C-45.
Drlg. 785 ft., Red beds.

Stogner et al's No. 1 Richardson, 1,980 ft. N and 660 ft. E. Sec. 4. Blk. A-37, P.S.L.
Drlg. 3,425 ft.; no shows; top Yates 2,950 ft.

J. W. Trippiehorn's No. 1 Ogden, 330 ft. from S and 2,310 ft. from W lines of Sec. 6, Blk. A-46, P.S.L. Sur.
Cellar and pits.

Wahlenmaier et al's No. 1 Odessa Ranch Co., 1,320 ft. from N and E of Sec. 10, Blk. A-32, P.S.L. Sur.
Drlg. 155 ft., red shale.

Wahlenmairer et al's No. 1 Cox Estate, 1,320 ft. from N and W of Sec. 8, Blk. A-33. Location.

York & Harper's No. 1 Hereford Stock Farms, C Labour 12, League 315, Parmer Co. School Lands.
Drlg. 3,785 ft., anhydrite; top Yates 3,530 ft.

BREWSTER COUNTY

F. C. Dodson's No. 1 Texas American Syndicate, 660 ft. from N and E, Sec. 66, Blk. 10, G.H.&S.A. Sur.
Drlg. 130 ft., lime.

Joiner et al's No. 1 McIntyre, 353 ft. from S, 2,390 ft. from E of Sec. 31, Blk. 352, W. M. Mitchell Sur.
T.D. 2,130 ft., lava; S.D. for orders.

King & Franklin's No. 1 Gage Est., C Sec. 138, Blk. 22, G.H.&S.A. Sur.
Drlg. 800 ft., lime.

G. H. Storey's No. 1 Wilson, 1,980 ft. from N and E lines of Sec. 3, Blk. 212, T.&St.L. Sur.
Rigging up Star machine.

S. G. Smith's No. 1 Decie, 2,490 ft. from S and E. Sec. 7. Blk. 1.
Drlg. 778 ft., lime.

COCHRAN COUNTY

Kelsey's No. 1 Slaughter, C Labour 36. League 150, R.C.S. Lands.
Derrick.

West Texas Development Co.'s No. 1 Slaughter, near C of Labour 53, League 149, Randall Co. School Lands.
Derrick

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topped sand and was bottomed at 1,395 feet. When bailed in produced in excess of 100 bbls.

Northwest of the Muenster Pool, about 2 miles, Bridwell and others' No. 1 Trew, topped lime at 1,475 feet and went 9 feet into the pay after which casing was set. When swabbed before setting pipe it showed for estimated 200 bbls. daily.

Jones County

In Jones County, Meredith & Donnelly's No. 1 Tittle, near the town of Trent and about 2 miles south of the Noodle Creek Field, is preparing to start drilling within 10 days. This test is on subsurface geology. Danciger Oil & Refining Co. purchased 90.6 acres north of the new well and several other companies have contracted to purchase spreads in the block. Contract depth of the well is 3,100 feet unless production is found at a lesser depth.

A wildcat on the M. L. Smith 1,500-acre tract in the G. A. Parker Survey, Brown County, near the center of 11,500-acre block, will be drilled to the Ordovician and Cambrian limestone horizons. It will be drilled by W. W. McDonald and R. B. Campbell.

In Young County, Charles E. Knox and others' No. 1 W. B. Harrison, reported last week as extending the Knox-Manning Field, increased to around 400 bbls. per day when deepened to 2,771 feet after a small shot with nitroglycerin. This well, in the T.E.&L. Survey No. 23, is about a mile west of production.

There were 83 new locations in the North and North Central districts during the week, an increase of 21 new tests over the previous seven days. In North Texas, Archer, Young and Wichita Counties led in activity and in North Central Texas, Shackelford County is ahead in both active work and new locations.

PANHANDLE

With 20 new locations in the Panhandle district last week there is no let-up of activity. Interest is centered on eastern Wheeler County where the trend is swinging to the southeast and where several large producers have been completed lately in the granite wash horizons. Hutchinson County is also active while activity in Gray County has dropped off somewhat.

J. R. Phillips' No. 2 Moore, in Hutchinson County, completed several weeks ago, made a five-day proration test and pumped at the rate of 468 bbls. daily. Total depth is 3,035 feet and it had pay from 2,900-3,032 feet. This was the first proration test made.

In the Panhandle area 11 new producers were added last week. Five new oil wells were completed in Wheeler County, Gray County had four new producers and Hutchinson County two.

One of the largest producers yet found in the Woodley-Osborne Field of Wheeler County was brought in last week. It is Magnolia Petroleum Co.'s No. 1 Jeff Mankins, in Section 53, Block 13, H.&G. N. Survey, which swabbed 90 bbls. of oil in six hours from lime at 2,230 feet. First pay at 2,185-90 feet showed 30 bbls. and increase was struck at 2,207-18 feet and at 2,219-24 feet.

In Gray County, Sun Oil Co.'s No. 7-A Combs-Worley, Section 35, Block 3, I.&G.N. Survey, 3 miles northwest of LeFors, was completed for better than 1,300 bbls. daily from granite wash between 2,842-93 feet.

WEST TEXAS COMPLETIONS

Ector County

Westbrook Oil Co.'s No. 3 Addis, total depth 3,968 feet, top pay 3,863 feet, shot with 240 quarts from 3,855-3,955 feet, initial production 105 bbls. of oil per day, flowing through 2-inch tubing.

Ward County

Atlantic Oil Producing Co.'s No. 19 W. D. Johnson, total depth 2,540 feet, top pay 2,300 feet, initial production 105 bbls. of oil per day, flowing through 1¼-inch tubing; No. 1 Monroe, total depth 2,451 feet, top pay 2,333 feet, shot with 90 quarts from 2,380-2,410 feet, initial production 153 bbls. of oil per day, flowing through 1¼-inch tubing after shot. California Co.'s No. 24 Durgin, total depth 2,599 feet, top pay 2,355 feet, shot with 400 quarts from 2,330-2,530 feet, initial production 289 bbls. of oil per day, flowing through casing. Gulf Production Co.'s No. 54 O'Brien, total depth 2,788 feet, top pay 2,614 feet, shot with 180 quarts from 2,626-2,775 feet, initial production 460 bbls. of oil per day, flowing through 2-inch tubing with 639,000 feet of gas daily. Westbrook & Caton's No. 5 Bennett, total depth 2,529 feet, top pay 2,306 feet, initial production 1,244 bbls. of oil per day, flowing through casing.

Fisher County

Southern Oil Corp.'s No. 2 King, total depth 3,125 feet, plugged back to 3,123½ feet, top pay 3,111 feet, treated with 1,000 gallons of acid, initial production 1,200 bbls., swabbing in 24 hours.

Winkler County

T. J. Jefferies and others' No. 1 Brown & Altman, total depth 3,204 feet, top pay 3,110 feet, shot with 100 quarts from 3,110-3,200 feet, initial production 131 bbls. of oil per day, flowing through 2-inch tubing. Sid Richardson's No. 1 Hill, total depth 3,846 feet, top pay 3,132 feet, plugged back to 3,155 feet, shot with 40 quarts from 3,125-45 feet, initial production 15 bbls. of oil per day, flowing through 2-inch tubing.

NORTH TEXAS COMPLETIONS

Archer County

L. T. Burns' No. 1 M. P. Andrews, total depth 985 feet, dry and abandoned; No. 1-X L. F. Wilson estate, total depth 1,415 feet, dry and abandoned. Fain-McGaha Oil Corp.'s No. 38 Mrs. C. S. Arnold, total depth 1,217 feet, top pay 1,199 feet, initial production 200 bbls. of oil per day, swabbing. J. C. Hamer and others' No. 1 Harmonson estate, total depth 937 feet, dry and abandoned. Hamer and Scholl's No. 12 Longley estate, total depth 1,026 feet, dry and abandoned. W. B. Hamilton's No. 26 Coffield, total depth 1,266 feet, top pay 1,259 feet, initial production 50 bbls. per day; No. 3 D. C. Giddings (Wilkins estate), total depth 1,226 feet, dry and abandoned; No. 25 W. I. Pace, total depth 1,200 feet, dry and abandoned.

Mack Oil Co.'s No. 5 J. S. Bridwell, total depth 932 feet, top pay 929 feet, initial production 20 bbls. of oil and 5 bbls. of water per day. Magee and Stipe's No. 3 William Justice, total depth 1,088 feet, top pay 1,076 feet, initial production 35 bbls. per day. Perkins and Cullum's No. 10 C. L. Abercrombie, total depth 1,016 feet, top pay 992 feet, initial production 25 bbls. of oil per day; No. 12 C. L. Abercrombie, total depth 1,231 feet, dry and abandoned; No. 150 Falls, total depth 1,140 feet, top pay 1,113 feet, initial production estimated 80 bbls. of oil per day; No. 152 Falls, total depth 1,165 feet, top pay 1,142 feet, initial production 75 bbls. of oil per day; No. 153 Falls, total depth 1,134 feet, top pay 1,111 feet, initial production estimated 70 bbls. of oil per day.

Continental Oil Co.'s No. 10-D Falls, total depth 1,086 feet, top pay 1,070 feet, initial production 31 bbls. of oil in 24 hours, pumping; No. 10-E Falls, total depth 1,113½ feet, top pay 1,106 feet, initial production 56 bbls. of oil in 24 hours. Petroleum Producers' No. 14 Harmonson estate, total depth 975 feet, top pay 966 feet, initial production 75 bbls. of oil per day; No. 5-D J. T. Richardson, total depth 1,267 feet, top pay 1,252 feet, initial production 30 bbls. of oil per day. Ray and Staniforth's No. 16 T. B. Wilson, total depth 1,605 feet, top pay 1,599 feet, initial production 100 bbls. of oil per day; No. 3-B T. B. Wilson, total depth 1,603 feet, top pay 1,599 feet, initial production 200 bbls. of oil per day. L. A. Wilkins and others' No. 1 Archer County, total depth 965 feet, dry and abandoned.

Clay County

E. G. Boardman and others' No. 1 C. T. Taylor and others, total depth 1,320 feet, dry and abandoned.

Jack County

J. Franklin Smith's No. 1 J. W. Tanner, total depth 820 feet, dry and abandoned.

Montague County

O. V. Beck's No. 14 Mrs. C. L. Davenport and others, total depth 1,678 feet, top pay 1,661 feet, initial production pumped 972 bbls. of oil in 72 hours. Benton and Holmes' No. 6-B Mrs. C. L. Davenport and others, total depth 1,678 feet, top pay 1,664 feet, initial production 2,880 bbls. of oil in 24 hours, flowing and swabbing. Continental Oil Co.'s No. 1 F. M. O'Neal, total depth 1,739½ feet, top pay 1,734 feet, initial production 170 bbls. of oil in 24 hours, pumping.

Wichita County

American Prod. Corp.'s No. 8 J. E. Roller estate, total depth 817 feet, dry and abandoned. Burk Royalty Co.'s No. 6 Allen and Kemp, total depth 1,260 feet, dry and abandoned. C. W. Clark and others' No. 5-B Allen and Kemp, total depth 840 feet, top pay 835 feet, initial production 15 bbls. of oil and 5 bbls. of water per day. Texas Co.'s No. 18 Allen and Kemp, total depth 466 feet, top pay 457 feet, initial production 7 bbls. of oil per day.

Young County

Brazelton Brothers' No. 5 R. B. Ward (Belknap Coal Co.), total depth 609 feet, top pay 600 feet, initial production 40 bbls. of oil per day. Cable Oil Co.'s No. 5 J. Williams, total depth 604 feet, top pay 593 feet, initial production 6 bbls. of oil per day. S. D. Glover's No. 1-B C. W. Johnson, total depth 521 feet, dry and abandoned. B. N. Hones' No. 11 fee, total depth 915 feet, top pay 908 feet, initial production 40 bbls. of oil per day. Martin and Son's No. 2 Belknap Coal Co. (Ward), total depth 604 feet, top pay 594 feet, initial production 72 bbls. of oil per day. R. F. Morgan and others' No. 1 Belknap Coal Co., total depth 630 feet, dry and abandoned. Texas Co.'s No. 8-B Jeffery estate, total depth 746 feet, top pay 739 feet, initial production 40 bbls. of oil per day. D. L. Wolf and others' No. 2 L. Baker, total depth 465 feet, dry and abandoned. Charles Knox and others' No. 1 W. B. Harrison, total depth 2,769 feet, top pay 2,757 feet, shot with 10 quarts from 2,757-64 feet, initial production 346 bbls. of oil per day, flowing.

WICHITA FALLS COMPLETIONS

Archer County

Consolidated Oil Co. and others' No. 3-A S. L. Scott, total depth 1,162 feet, dry and abandoned. F. P. Cullum's No. 24 Falls, total depth 1,156 feet, pay 1,138-56 feet, initial production 65 bbls; No. 26 Falls, total depth 1,146 feet, pay 1,128-46 feet, initial production estimated 80 bbls. daily; No. 27 Falls, total depth 1,152 feet, pay 1,135-52 feet, initial production estimated 85 bbls. daily; No. 28 Falls, total depth 1,160 feet, pay 1,142-60 feet, initial production estimated 80 bbls. daily; No. 29 Falls, total depth 1,149 feet, pay 1,131-49 feet, initial production 85 bbls.; No. 30 Falls, total depth 1,162 feet, pay 1,147-62 feet, initial production 100 bbls.

Continental Oil Co.'s No. 11-B Falls, total depth 1,138 feet, pay 1,111-38 feet, initial production 64 bbls. per day pumping; No. 12-B Falls, total depth 1,124 feet, pay 1,109-24 feet, initial production 56 bbls. per day pumping; No. 13-B Falls, total depth 1,124 feet, top pay 1,116 feet, initial production 50 bbls. per day pumping; No. 15-B Falls, total depth 1,126 feet, top pay 1,111 feet, initial production 41 bbls. per day pumping. Continental & Cullum's No. 22 Falls, total depth 1,147 feet, top pay 1,132 feet, initial production 31 bbls. per day pumping.

F. H. E. Oil Corp.'s No. 1 Francis Brezina, total depth 1,433½ feet, top pay 1,431 feet, initial production 55 bbls. W. B. Hamilton's No. 17 Cartwright Production Co., total depth 1,157 feet, top pay 1,140 feet, initial production 125 bbls.; No. 24 W. Coffield, total depth 1,251 feet, top pay 1,238 feet, initial production 135 bbls. Maxson & Panhandle's No. 30-B F. C. Green, total depth 1,099 feet, top pay 1,084 feet, initial production 35 bbls. Perkins & Cullum's No. 147 Falls, total depth 1,208 feet, top pay 1,191 feet, initial production 75 bbls.; No. 148 Falls, total depth 1,131 feet, top pay 1,108 feet, initial production 45 bbls.; No. 149 Falls, total depth 1,156 feet, top pay 1,137 feet, initial production estimated 100 bbls. daily; No. 151 Falls, total depth 1,213 feet, top pay 1,194 feet, initial production 200

Assistant Secretary of War to Address A. P. I. Meeting

Assistant Secretary of War Harry H. Woodring has accepted an invitation to speak before the meeting of the American Petroleum Institute Mid-Continent Production Division, to be held Wednesday and Thursday, April 10 and 11, in Amarillo, Tex. His talk, on "National Defense," will be given Thursday afternoon in the city auditorium. Mr. Woodring has oil interests in Kansas, his home state, and it is expected his talk will show something of the oil industry's importance in the event of war.

J. C. JOHNSTON

Details of organizing and planning the meeting fall largely on the shoulders of J. C. (Jimmie) Johnston, Continental Oil Co. in Borger, Tex., chairman of the Panhandle chapter A. P. I., which is host, and C. A. (Charlie) Daniels, chairman of the program committee. Production men from Kansas, Oklahoma, Arkansas, Texas and New Mexico will attend this annual spring meeting, at which subjects of live interest to the producing branch of the industry will be discussed.

C. A. DANIELS

bbls. F. D. Spratt and others' No. 1 J. S. Bridwell, total depth 950 feet, dry and abandoned. United Producers' No. 1 Irene Gathright, total depth 889 feet, dry and abandoned.

Cooke County

Ruwaldt & Couch's No. 1 Tony Trubenbach, total depth 1,648 feet, dry and abandoned.

Jack County

B. C. Gilmore and others' No. 1 J. D. Gillispie, total depth 531 feet, dry and abandoned. Fred Leidecker and other's No. 1 McClure, total depth 4,625 feet, top pay 4,549 feet, initial production 32 bbls. of oil and 3,000,000 feet of gas per day.

Throckmorton County

E. G. Boardman's No. 2 N. B. Davis, total depth 1,422 feet, dry and abandoned.

Wichita County

L. T. Burn's No. 15 T. Mitchell, total depth 1,875 feet, dry and abandoned. R. R. Clark and others' No. 38 Bickley estate, total depth 1,802 feet, junked and abandoned. W. B. Omohundro's No. 1 D. E. Hooks, total depth 1,210 feet, top pay 1,180 feet, initial production 20 bbls. Waggoner Refining Co.'s No. 2-X Waggoner Estate, total depth 1,561 feet, top pay 1,548 feet, initial production 201 bbls.

Wilbarger County

Consolidated Oil Co.'s No. 1-AA Waggoner Estate, total depth 1,907 feet, dry and abandoned. J. E. Dunaway and others' No. 5 Waggoner Estate, abandoned location.

Young County

C. W. Alcorn's No. 2 O. S. Perkins, total depth 748 feet, dry and abandoned. O. T. Anderson Oil Co.'s No. 1 Belknap Coal Co., total depth 653 feet, top pay 644 feet, initial production 35 bbls. L. T. Burns' (formerly E. R. Perkins and others) No. 1 J. L. Castleman, total depth 1,196 feet, top pay 1,188 feet, initial production 35 bbls. F. E. Butler and others' No. 1 W. R. Ledbetter, total depth 600 feet, dry and abandoned. R. H. Helm and others' No. 1 J. M. Kirkland, total depth 688 feet, top pay 675 feet, initial production 20 bbls. J. W. Keithley and others' No. 1 T. L. Griffin, total depth 1,300 feet, dry and abandoned. Knight Oil Corp. & Martin's No. 8 G. B. Hamilton, total depth 897 feet, top pay 870 feet, initial production 30 bbls. Petroleum Producer's No. 11 J. C. Graham, total depth 697 feet, top pay 688 feet, initial production 15 bbls. Nash & Windfohr's No. 16 Graham-Vick, total depth 2,594 feet, top pay 2,585 feet, initial production 190 bbls.

COMPLETIONS IN TEXAS PANHANDLE

Gray County

Humble Oil & Refining Co.'s No. 4 Palmer, total depth 3,115 feet, top pay 3,091 feet, initial production 354 bbls. per day, pumping. King Royalty Co.'s No. 3 Brown, total depth 3,270 feet, top pay 3,165 feet, shot with 330 quarts from 3,166-3,255 feet, initial production 200 bbls. day pumping. Plains Holding Co.'s No. 2 Chapman, total depth 2,814 feet, top pay 2,770 feet, shot with 300 quarts from 2,740-2,814 feet, initial production 86 bbls. day, pumping. Skelly Oil Co.'s No. 22 East Shaffer, total depth 3,265 feet, top pay 3,158 feet, shot with 330 quarts from 3,170-3,265 feet, initial production 372 bbls. day, pumping. Southern Petroleum Exploration Co.'s No. 4 Noel, total depth 3,214 feet, top pay 3,155 feet, shot with 200 quarts from 3,155-3,210 feet, initial production 246 bbls. day, pumping.

Wheeler County

Champlin Refining Co.'s No. 7 Williams, total depth 2,528 feet, top pay 2,305 feet, initial production 1,936 bbls. oil with 9,000,000 feet of gas per day, flowing. Shell Petroleum Corp.'s No. 6 D'Spain, total depth 2,541 feet, top pay 2,520 feet, initial production 430 bbls. a day, pumping; No. 8 D'Spain, total depth 2,527 feet, top pay 2,385 feet, initial production 282 bbls. per day, pumping. Skelly Oil Co.'s No. 13 Derrick, total depth 2,523 feet, top pay 2,407 feet, no increase obtained after treating with 1,000 gallons of acid, initial production 339 bbls. per day pumping. Texas Co.'s No. 7 Keller, total depth 2,530 feet, top pay 2,442 feet, initial production 4,018 bbls. oil and 27,000,000 feet of gas per day, flowing.

Hutchinson County

J. R. Phillips' No. 2 J. W. Moore, total depth 3,035 feet, top pay 2,900 feet, shot with 600 quarts from 2,900-3,032 feet, initial production 468 bbls. per day, pumping. Harry Steckoll's No. 3 Plemons "G" (Whittenburg), total depth 3,060 feet, top pay 3,011 feet, shot with 100 quarts from 3,005-3,055 feet, initial production 328 bbls. per day, pumping.

Optimism in Chicago Area Gasoline Market

(Continued from Page 130)

have shied in a great many cases at actually placing orders, due partly to the complexity of state regulations, etc. Quotations on tractor fuels have been closely following third-grade gasoline. At the same time, kerosene orders have been fair, but the prices have been a little easier than was expected. A few sources have reported quite low prices, although most of the larger sellers have held firm. Stocks are regarded as being strictly moderate.

Heating Oils

Advance of the season has tended to take away from heating oils most of the remaining interest that had been shown in them. Buying, both consumer and distributor, has reached a low level, but prices on the better grades of material, are holding well in the tank car market. Little fill-up business is now expected for the rest of the season.

Industrial Oils

No change in industrial fuel and gas oils has been noted. Buying by the large consumers is limited to immediate needs only. Steel mill activity has been fitful and not as high in the aggregate as some reports would indicate. The same is true in some other lines. Nothing in the railroad field appears productive of much new business immediately.

Lubricants

Lubricants are dull but quite firm at this time, and a fair amount of interest is being taken. Prices show little or no change.

Wax

Wax business is slack and the price structure barely holding, with a quite easy undertone. Orders are limited, stocks still rather extensive.

Naphthas

Naphthas and solvents are quiet, but tank car prices are holding, following recent tank wagon readjustments here.

Coke

Petroleum coke is rather quiet but the price situation is little changed. Buying has been along routine lines. Offerings are still not overly large.

SHELL ADVERTISING UNITED

For the first time in their history the three Shell companies, Shell Eastern Petroleum Producers Corp., Shell Oil Co., and Shell Petroleum Corp., will unite in a national advertising campaign within the next eight months, employing a radio hour, newspapers, national weekly publications and outdoor posters. Heretofore, in their advertising as in their operation, the three companies have functioned entirely independent of one another.

HENRY STOAKLEY DIES

SARNIA, Ontario, Mar. 23.—Henry Stoakley of Copleston, Ontario, died here recently, aged 81. For some 18 years he was employed on the oil properties of J. L. Englehart in the Petrolia Field.

West Texas Wildcats

(Continued from Page 138)

COKE COUNTY

Haggerty et al's No. 1 Gaston, 340 ft. from S and 654 ft. from W, Sec. 11, Jos. Young Sur. (old well deepening).
T.D. 2,808 ft., lime; underreaming 6-in. csg. 1,300 ft.; water from 2,785-2,795 ft.

CRANE COUNTY

Cranfill Bros.' No. 1 Tubbs, 330 ft. from S and W of Sec. 11, Blk. B-27, P.S.L. Sur.
Moving in material.

Gulf Prod. Co.'s No. 1 M. B. McKnight, 660 ft. from S and W, Sec. 9, Blk. B-21.
Moving in machine.

Gulf Prod. Co.'s No. 1 Waddell, C NW NW Sec. 4, Blk. B-27, P.S.L. Sur.
T.D. 3,738 ft.; fishing for tools

Gulf Prod. Co.'s No. 9 Waddell, C of NE. Sec. 11, Blk. B-23, P.S.L. Sur.
T.D. 3,518 ft., lime; cleaning out; shot 360 qts. from 3,244-3,496 ft.; est. 30 bbls. daily.

Wahlenmaier Pet. Corp.'s No. 1 Kloh, 330 ft. from S and 1,609 ft. from W, Sec. 33, Blk. 44, Twp. 3s, T.&P. Sur.
T.D. 3,340 ft., lime; bailed down and after standing 14 hours bailed 4 bbls .of oil.

CROCKETT COUNTY

Eppenauer Drlg. Co.'s No. 1-C Powell, 1,600 ft. from S and 250 ft. from E, Sec. 53, Blk. B.B.
Elev. 2,665 ft.; T.D. 2,245 ft.; running 6-in. csg.

Leslie-Hiller et al's No. 1 Todd, 1,200 ft. N and 330 ft. E. Sec. 26, Blk. WX, G.C.& S.F. Sur.
S.D. 580 ft. for casing.

Humble Oil & Ref. Co.'s No. 1 Couch, C NW Sec. 3, Blk. QR, G.C.&S.F. Sur.
Temporarily abnd. 1,881 ft.; elev. 2,538 ft.

CULBERSON COUNTY

Anderson-Pritchard Oil Corp., Magnolia Pet. Co. et al's No. 1 Borders, 1,255 ft. N and 2,305 ft. from W, Sec. 34, Blk. 69, P.S.L. Sur.
T.D. 1,124 ft.; fishing parted 12½-in. csg.

Miller Bros.' No. 1 fee, 1,900 ft. from N and 660 ft. from E line of Sec. 21, Blk. 97, P.S.L. Sur.
T.D. 2,107 ft., sand; ran 6-in. csg. and S.D. for orders.

Wood et al's No. 1 Hall, 250 ft. from S and 85 ft. from E. Sec. 11, Blk. 54½, 16 miles N of Van Horn, P.S.L. Sur.
S.D. 246 ft.

DAWSON COUNTY

Adams & Turner's No. 1 John Robinson, 1,320 ft. from N line, 1,320 ft. from W line of Sec. 46, Blk. M, E.L.R.R. Sur.
Drlg. 4,528 ft., lime.

ECTOR COUNTY

Atlantic Oil Prod. Co.'s No. 1 T. P. Land Trust, 440 ft. from N and W of SE Sec. 11, Blk. 43, Twp. 1s, T.&P. Sur.
T.D. 4,391 ft.; plugged back to 4,300 ft.; Shot 380 qts. 4,175-4,300 ft.; cleaning out; 2,000 ft. water and very little oil in hole; cannot bail down.

Barnsdall Oil Corp.'s No. 2 Smith, 330 ft. from S and W lines of Sec. 1, Blk. 43, Twp. 1s, T.&P. Sur.
Derrick.

W. A. Black & Sons' No. 3 Connell, 330 ft. from S and 1,310 ft. from W lines of Sec. 1, Blk. B-16, P.S.L. Sur.
Location.

Callahan et al's No. 1 Connell, 330 ft. from N and 990 ft. from W, Sec. 10, Blk. 30, Twp. 1s.
Drlg. 3,000 ft., anhydrite.

Empire Gas & Fuel Co.'s No. 1 Cummins, 440 ft. from S and E, Sec. 10, Blk. 45, Twp. 1n, T.&P. Sur.
Drlg. 810 ft. red rock; carrying 12½-in. csg.

G. Farley's No. 1 Connell, 990 ft. from S and 330 ft. from E, Sec. 11, Blk. B-16, P.S.L. Sur.
T.D. 3,668 ft.; shot 400 qts. 3,482-3,668 ft.; flowed 162½ bbls. first 24 hrs. after shot; tubed and waiting on proration test.

Gulf Prod. Co.'s No. 1 Goldsmith, C of NW, Sec. 10, Blk. 44, Twp. 1s, T.&P. Sur.
T.D. 1,746 ft. salt and Red beds; running 10-in. csg.

International Pet. Corp.'s No. 1 Cowden, 660 ft. from S and E, Sec. 25, Blk. 44, Twp. 3s, T.&P. Sur.
Drlg. 3,580 ft., gray sand; hole full salt water at 3,562 ft.

Landreth Prod. Co.'s No. 1 Clarence Scherbauer, 660 ft. from S and E lines of Sec. 20, Blk. 44, Twp. 1n, T.&P. Sur.
T.D. 4,236 ft.; plugged back to 4,186 ft.; S.D.

Landreth Prod. Co.'s No. 1-B O. B. Holt, 660 ft. from N and 1,980 ft. from E lines of Sec. 19, Blk. "A," P.S.L. Sur.
Cellar and pits.

Landreth Prod. Co.'s No. 1 Cowden Heirs, 440 ft. from S and W, Sec. 18, Blk. 44, Twp. 1n, T.&P. Sur.
T.D. 860 ft., sandy red rock; underreaming 12½-in. csg.

Penrose et al's No. 1 Kloh & Rumsey, 2,310 ft. from S and E, Sec. 31, Blk. 45, Twp. 1s, T.&P. Sur.
Elev. 3,154 ft.; T.D. 3,473 ft.; S.D. for 6⅝-in. csg.; 1,000 ft. salt water in 24 hrs. from 3,465-73 ft

Phillips Pet. Co.'s No. 1 Scharbauer, 990 ft. from S and 330 ft. from E, Sec. 16, Blk. B-15.
Drlg. 3,897 ft., lime.

EL PASO COUNTY

Tri-State Oil Co.'s No. 1 Kinkel, 190 ft. from N and 550 ft. from E, Sec. 237, A.T.&S.F. Sur.
Drlg. 75 ft., shale.

FISHER COUNTY

Merry Bros. and Perrini's No. 1 Howard, 1,320 ft. from N and 660 ft. from E, Sec. 180, Blk. 2, H.&T.C. Sur.
T.P. 3,665 ft.; T.D. 3,679 ft.; plugged back to 3,675 ft.; pumped 126 bbls. oil and 210 bbls. water in 24 hrs.

GARZA COUNTY

N. L. Richards' No. 1 Sullivan, 330 ft. from N and W, Sec. 3, Blk. 5, K. Aycock Sur.
T.D. 360 ft.; running 10-in. csg.

GLASSCOCK COUNTY

Capitan O. Co.'s No. 1 Gilliam, 2,310 ft. from S and 1,980 ft. from E, Sec. 21, Blk. 35, Twp. 2s, T.&P. Sur.
Elev. 2,610 ft.; T.D. 2,116 ft., lime; set 6⅝-in. csg.; waiting on cement.

John I. Moore et al's No. 1 McDowell, 2,310 ft. from S and 2,397 ft. from E, Sec. 21, Blk. 34, Twp. 2s, T.&P. Sur.
Drlg. 1,870 ft., red rock.

John I. Moore et al's No. 1 J. S. McDowell, 1,980 ft. from N line and 660 ft. from E line of Sec. 22, Blk. 34, Twp. 2s, T.&P. Sur.
Topped lime 9,471 ft.; show oil and gas 9,484-9,520 ft.; cmtd. 7⅝-in. csg. at 9,470 ft.; hole unloaded at 9,520 ft.; no commercial production of either oil or gas; drlg. ahead at 9,628 ft. in brown and gray lime.

HOWARD COUNTY

Dorn et al's No. 1 Kloh, 330 ft. from S and E, Sec. 45, Blk. 30, Twp. 1n, T.&P. Sur.
Elev. 2,287 ft.; drlg. 2,630 ft., lime; T.P. 2,585 ft.; hole filled 500 ft. in oil in 5 hrs.

C. Henson et al's No. 1 B. Scott, 330 ft. from N and 1,650 ft. from E, Sec. 93, Blk. 29, T.&P. Sur.
T.D. 1,254 ft.; set 5-in. csg. at 1,250 ft.; waiting on cmt.

Slagel's No. 1 Foster, 990 ft. from S and 330 ft. from W, Sec. 43, Blk. 29.
T.D. 690 ft.; fishing parted 10-in. csg.

IRION COUNTY

Lowe, Delaney et al's No. 5 Nutt, 490 ft. from N and E of SW¼ Sur. 6, Gonzales County School Lands.
Drlg. 1,435 ft., shale.

JEFF DAVIS COUNTY

C. M. Joiner's No. 1 Jones & Coffield, 770 ft. from N and 1,322 ft. from E, Sec. 8, Blk. 3, H.&T.C. Sur.
Drlg. 765 ft., granite wash.

JONES COUNTY

Campbell et al's No. 1 Rowell, in E hair of W half, Sec. 6, T.&P. Sur.
T.D. 950 ft.; shut down.

Campbell et al's No. 1 Enevill, 1,400 ft. from N and 270 ft. from W, Sec. 2, M.E.&P. Sur., ½ mile S of Anson.
Drlg. 2,125 ft., lime.

Cal-Tex Oil Co.'s No. 1 Smith, 1,400 ft. from S and 2,000 ft. from E, Sec. 26, Blk. 19, T.&P. Sur.
Drlg. 2,121 ft., lime.

Fondran Prod. Co.'s No. 1 S. R. Cox Jr., 200 ft. from S and 3,700 ft. from E, Sec. 74, Blk. 14, T.&P. Sur.
Drlg. 1,200 ft., lime.

Dr. C. E. Johnson's No. 1 Young, 1,800 ft. from N and 750 ft. from W of SE 290 acres of B. Travenio Sur.
T.D. 1,680 ft.; underreaming 6-in. csg.

Owen et al's No. 1 Johnson & Dunwoody, 3,750 ft. from S and 330 ft. from W, Sec. 6, Blk. 17, T.&P. Sur.
Spudded and S.D.

Richards et al's No. 1 Ransom, 200 ft. from N and E, Sec. 244, B. M. Clopton Sur.
S.D. 750 ft.

T. O. Shappell's No. 1 Stevenson, 150 ft. from N and 2,411 ft. from W, Sec. 7, Blk. 16, T.&P. Sur., 7 mi. SW of Hawley.
Drlg. 1,185 ft., lime.

T. K. Simmons' No. 1 T. M. Harrell, 200 ft. from S and 1,050 ft. from E of Sec. 7, Orphan Asylum Lands.
T.D. 1,860 ft.; shut down.

United Producers No. 1 T. P. Wood, 1,000 ft. from N and 450 ft. from W lines of farm, B. Traverino Sur. No. 190.
Drlg. 1,250 ft., lime.

LOVING COUNTY

D. C. Evans' No. 1 W. D. Johnson, 2,310 ft. from N and 1,650 ft. from W, Sec. 13, Blk. 57, Twp. 1, T.&P. Sur.
T.D. 2,032 ft., anhydrite; rigging up.

Mason Oil Co.'s No. 1 Kyle, 1,980 ft. from S and E, Sec. 22, Blk. 55, Twp. 1, T.&P. Sur.
T.D. 495 ft., quicksand; jarring on tools.

LYNN COUNTY

Hart Oil Co.'s No. 1 Edwards, 220 ft. from N and 200 ft. from W of SE Sec. 29, L.&S.V. Sur.
Elev. 3,112 ft.; S.D. 3,980 ft. for repairs.

MARTIN COUNTY

Wright & Scott's No. 1 Flannigan, 330 ft. N and E, Sec. 22, Blk. 37, Twp. 1s, T.&P. Sur.
S.D. 100 ft.

MITCHELL COUNTY

Sawtell & Grueber's No. 1 Morrison
S.D. 1,020 ft.

McCULLOCH COUNTY

Cardinal Oil Co.'s No. 4 White Baker, 270 ft. from N and 1,962 ft. from E, Dewey Sur.
Location.

Goggins' No. 1 Craven Estate, 1,390 ft. from S and 2,480 ft. from W, Gus Dreiss Sur.
Drlg. 740 ft., lime.

Honea et al's No. 1 Cox, 450 ft. from S and 150 ft. from E, David Pope Sur.
S.D. 846 ft., black shale.

Miller et al's No. 1 Black, 160 ft. from N and 175 ft. from E, Sur. 290, H.&T.C. Sur., 3 miles E of Placid.
S.D. 605 ft.

Geo. Poulter et al's No. 1 J. R. Hall, 2,600 ft. from SE and 200 ft. from E, Sec. 192, State Sur., 12½ miles N of Brady.
T.D. 754 ft., shale; est. 6,000,000 ft. gas 635-40 ft.

Skaggs & Brewer's No. 1 Dunn, 190 ft. from S and 570 ft. from E, Sec. 951, T. L. Hartig Sur.
Drlg. 709 ft., lime; rainbow oil 708 ft.

PECOS COUNTY

Cardinal Oil Co.'s No. 1 White & Baker,

2,310 ft. from S and 330 ft. from W, Sec. 51, Blk. Z, T.C. Sur.
Drlg. 1,887 ft., lime; show oil and gas 1,832 ft.
Gulf Prod. Co.'s No. 5 White & Baker, 330 ft. from N and E lines of Sec. 88, Blk. 194, G.C.&S.F. Sur.
Rigging up machine.
International Pet. Co.'s No. 1 White & Baker, 2,310 ft. from S and 330 ft. from E, Sec. 4, Blk. 207, T.C. Ry. Sur.
T.D. 816 ft.; set 2¼-in. csg.; waiting on cmt.
Messenger's No. 1 Dr. Sibley, 4,930 ft. from S and 990 ft. from W, Sec. 6, Blk. 9, H.&G.N. Sur.
Location.
Trans-Tex. Oil Co.'s No. 1 Caldwell, 330 ft. from E line and 330 ft. from S line of Sec. 27, Blk. 40, Twp. 9, T.&P. Sur.
S.D. 1,680 ft. for csg.

REAGAN COUNTY

Byrd-Frost Inc.'s No. 1 Boyd, 1,320 ft. from S and E of Sec. 6, Blk. E, L.V.S.&V. Sur.
Drlg. 597 ft., red shale.
Dobbs' No. 1 Friend, 2,310 ft. from S and 660 ft. from W of Blk. 3, Wm. Allen Sur., 3 or 4 miles S of Big Lake.
Drlg. 1,640 ft., lime.
Skelly Oil Co.'s No. 1-D H. S. Grayson, 1,980 ft. from N line and 660 ft. from W line of Sec. 33, Blk. 8, University Land Sur.
Drlg. 9,748 ft., hard lime; no show oil or gas.

REEVES COUNTY

J. E. Cunningham's No. 1 Altman, 2,310 ft. from N line and 1,980 ft. from E line of Sec. 1, C. C. Wyatt Sur.
T.D. 3,738 ft.; recmtd. 5¼-in. csg. 3,738 ft.
Herbert Oil Co.'s No. 1 Williams & Walker, 5,280 ft. from S and 1,320 ft. from E, Sec. 17, Blk. 6, H.&G.N. Sur.
Spudded and S.D.
Melrose Oil Co.'s No. 1 L. P. Woods, 150 ft. from NE lines and 3,475 ft. from W line of survey, Willett Holmes Sur. No 100.
S.D. 2,507 ft.
R. Wells' No. 1 James, 396 ft. from N and 330 ft. from E of James tract in Sec. 16, D. Diaz Sur.
S.D. 1,100 ft.

SCHLEICHER COUNTY

John M. Cooper et al's No. 1 Bert Page, 1,290 ft. from N line, 1,470 ft. from W line of Sec. 40, Blk. L, G.H.&S.A. Sur.
T.D. 5,987 ft.; cleaning out to resume drlg.
W. C. Proctor et al's No. 1 Judkins & Spencer, 1,920 ft. from S and W of W. W Russell grant.
Moved off tools.

SCURRY COUNTY

Coffield & Guthrie's No. 1 Holliday, 2,310 ft. from N and 330 ft. from W, Sec. 120 Blk. 97, H.&T.C. Sur.
T.D. 2,697 ft.; plugged back to 2,075 ft.; shut down.
McLaughlin's No. 1 Allen, 1,331 ft. from N and 1,338 ft. from E. Sec. 298, Blk. 97.
Drlg. 610 ft., red shale.

STERLING COUNTY

Merry Bros. & Perrini's No. 1 Standaberry, 1,980 ft. from N and E, Sec. 26, Blk. 39 W.&N.W. Sur.
Drlg. 2,970 ft., sandy shale.

STONEWALL COUNTY

Merry Bros. and Perrini et al's No. 1 Williams, C SW of SW Sec. 6, Blk. C, A.B &M. Sur.
S.D. 3,000 ft.

SUTTON COUNTY

Texas et al's No. 1 Mower, 1,980 ft. from S and W of Sec. 39, Blk. 5, T.W.&N.G. Sur.
S.D. 4,270 ft.; slight show oil at 4,245-58 ft.

TAYLOR COUNTY

Eastland Oil Co.'s No. 1 Tittle, 660 ft. from N and W, Sec. 37, Blk. 19, T.&P. Sur., 1 mile NE of Trent.
Machine

TERRELL COUNTY

W. A. Sudderth's No. 1 Phelps, 2,157 ft. from N line and 2,482 ft. from the W line of Sec. 5, Blk. 4-A, G. W. Turley Sur.
S.D. 5,635 ft.

TOM GREEN COUNTY

J. F. Jacobs et al's No. 1 De Long, 1,320 ft. from N and 2,640 ft. from E, George Smith Sur. No. 1,825 ft.
Drlg. 280 ft., lime.

UPTON COUNTY

Baldridge Oil Co.'s No. 1 S. Peck, 440 ft. from S and E, Sec. 29, Blk. 41, Twp. 4s. T.&P. Sur.
Drlg. 350 ft., red rock.
Gulf Prod. Co.'s No. 103 McElroy, 1,980 ft from S and 660 ft. from W, Sec. 197, Blk. F, C.C.S.D.&R.G.N.G. Sur.
Drlg. 12,038 ft.; showing no oil or gas.
Humble Oil & Ref. Co.'s No. 1 Pollock, C of NW, Sec. 4, Blk. M.
Elev. 2,758 ft.; drlg. 3,240 ft., anhydrite; top Yates 2,560 ft.
King Mountain Pet. Co.'s No. 1 Sherk, 330 ft. from S and W, Sec. 29, Blk. 1, M.K.&T Sur.
Drlg. 1,400 ft., salt and red rock.
Williams & Williams Drlg. Co.'s No. 1 Robbins, 1,600 ft. from S and 1,900 ft. from E, Sec. 4, G.C.&S.F. Sur.
Drlg. on iron at 2,040 ft.

WARD COUNTY

Alexander's No. 1 Richter, 1,650 ft. from NW, 1,170 ft. from NE line of Sec. 37 Blk. 34, H.&T.C. Sur.
T.D. 1,950 ft., anhydrite; S.D. for repairs.
Bradford et al's No. 1 E. R. Allen, 660 ft from NW line and 551 ft. from NE line Sec. 11, Blk. 5, H.&T.C. Sur.
T.D. 1,520 ft., anhydrite; shut down.
Caprito's No. 1 Hardage & Wilson, 2,310 ft from NE and 990 ft. from SE, Sec. 11, Blk. 34, H.&T.C. Sur.
Material.
Cook Drlg. Co.'s No. 1 Wood, 330 ft. from NW and SW, Sec. 5, W. F. Stewart Sur.
T.D. 2,548 ft.; plugged back to 2,527 ft.; S.D. for orders.
Eastland Oil Co.'s No. 1 Richter, 2,310 ft. from NW and 330 ft. from SW of Sec. 33, Blk. 34, H.&T.C. Sur.
T.D. 2,623 ft., lime; preparing to shoot; Broken pay from 2,270-2,610 ft.
Gulf Prod. Co.'s No. 55 O'Brien, 1,650 ft. N and 330 ft. from E, Sec. 18, Blk. F.
Drlg. 2,345 ft., anhydrite.
Gulf Prod. Co.'s No. 56 O'Brien, 2,310 ft. from N and 330 ft. from E, Sec. 18, Blk F.
Drlg. 1,290 ft., red rock.
Magnolia Pet. Co.'s No. 2 Sealy Estate, 2,310 ft. from S and 330 ft. from W, Sec. 43, Blk. F.
Drlg. 1,120 ft., anhydrite and red rock.
Postellio & Caprito's No. 1 Purcell, 330 ft from NE and 990 ft. from NW, Sec. 17, Blk. 34, H.&T.C. Sur.
T.D. 2,775 ft., lime; to start new hole.
Rector Oil Co.'s No. 1 Monroe, 660 ft. from SE and NE, Sec. 2, Blk. 1, W.&N.W. Sur.
T.D. 1,998 ft., anhydrite; S.D. for rotary.
Sageland Oil Corp.'s No. 2 Pure-Bennett, 1,650 ft. from NW and 2,310 ft. from SW S.D. 220 ft.
Jerry Sines' No. 1 Brown, 330 ft. from NW and NE, Sec. 13, Blk. 5, H.&T.C. Sur.
Drlg. 1,455 ft., anhydrite and salt.
Jerry Simes et al's No. 1 Miller, 330 ft. from N and NW of E cor. of Sec. 19, but in Sec. 20, Blk. 32, H.&T.C. Sur.
Drlg. 2,408 ft., lime.
West Texas O. & R. Co.'s No. 1-C University, 330 ft. from N and E. Sec. 6, Blk. 16
Drlg. 1,578 ft., sand; hole full water 1,550-78 ft.

WINKLER COUNTY

Barnsdall Oil Co.'s No. 1 Brown & Aultman, 2,310 ft. from N and W, Sec. 6, Blk. 5, P.S.L. Sur.
T.D. 2,626 ft., lime; S.D. for repairs; T.S. 2,461 ft.
Green Prod. Co.'s No. 1 J. F. Cross, 330 ft. from N and 2,310 ft. from W, Sec. 4, Blk. B-10, P.S.L. Sur.
Material.
Harry Adams' No. 2 Scarborough, 990 ft. from N line and 990 ft. from W line, Sec 3, Blk. 77, P.S.L. Sur.
Location.
Humble Oil & Ref. Co.'s No. 2-A Walton, 660 ft. from S and W, Sec. 48, Blk. 26, Derrick.
Magnolia Pet. Co.'s No. 6 Watton, 330 ft. from S and 1,650 ft. from W, Sec. 1, Blk. 26, P.S.L. Sur.
Coring 2,941 ft., lime; oil 2,830-35 ft.
C. Maxwell's No. 1 Clapp, 2,310 ft. from N and 330 ft. from E, Sec. 27, Blk. 26, P.S.L. Sur.
T.D. 3,487 ft.; plugged back to 3,200 ft.; shot; treated with 3,000 gals. acid; S.D. for orders; acid treatment did not help.
Maxwell & Atlantic's No. 2 Daugherty, 990 ft. from S and 330 ft. from E, Sec. 11, Blk. 26, P.S.L. Sur.
Drlg. 1,243 ft., anhydrite; water 1,065-80 ft.
Mid-Continent Pet. Corp.'s No. 2 Howe, 1,650 ft. from N and 330 ft. from W, Sec. 12, Blk. 26.
T.D. 2,989 ft.; T.P. 2,800 ft.; flowing 20 bbls. oil per day; may acidize.
Richardson's No. 1 Walton, 1,010 ft. from S and 330 ft. from W. Sec. 1, Blk. B-3.
S.D. 2,400 ft., anhydrite, for orders.
Sayre Oil Co.'s No. 2 Lum Daugherty, 990 ft. from S and 330 ft. from E lines of Sec. 2, Blk. 26, P.S.L. Sur.
Ready to spud.
Sayre Oil Co.'s No. 1 Leck, 330 ft. from S and E. Sec. 2, Blk. 26, P.S.L. Sur.
T.D. 2,737 ft., sand; S.D. for orders.
Sayre Oil Co.'s No. 2 Howe, 330 ft. from N and W, Sec. 12, Blk. 26, P.S.L. Sur.
T.D. 2,590 ft., salt; set 7-in. csg. at 2,577 ft.; waiting on cmt.
Skelly Oil Co.'s No. 2 Hailey, 1,320 ft. from N and 2,200 ft. from E, Sec. 25, Blk. B-11, P.S.L. Sur.
S.D. 3,090 ft.
Sloss Oil Co.'s No. 1 Lowett, 330 ft. from N and E. Sec. 36, Blk. 26, P.S.L. Sur.
Drlg. 1,681 ft., salt and anhydrite.
Sun Oil Co.'s No. 1 Hailey, 2,200 ft. from N and 440 ft. from E, Sec. 24, Blk. B-12, P.S.L. Sur.
T.D. 2,656 ft., sand; fishing for tools.
Texas Pacific Coal & Oil Co.'s No. 2 Daugherty, 1,650 ft. from S and 330 ft. from E, Sec. 2, Blk. 26, P.S.L. Survey.
Drlg. 660 ft., red rock.

East Central Texas Wildcats

(Continued from Page 135)

Sur., 2¼ miles S of Summerfield.
T.D. 1,488 ft.; D.S. stuck.
E. M. Thomason et al's No. 1 Addis Estate, 250 ft. S of survey and 150 ft. E of railroad, J. T. Jones Sur., 4 miles NW Alto.
Elev. 471 ft.; top Austin 4,897 ft.; cored 5,127-35 ft.; rec. Austin chalk; now fishing.
Wilson Stubbs Oil Co.'s No. 1 Rowborta, 450 ft. from S line, 150 ft. from W line of 100-ac. tract, 2 miles SW of Jacksonville, J. D. Wolfin Sur.
S.D. 1,553 ft.
T. J. Woods et al's No. 3 New Birmingham Dev. Co., 1,320 ft. from S and 150 ft. from E lines of 160-ac. tract, L. Jordan Sur., NE of No. 1.
Material.

ELLIS COUNTY

Beckner-Finley et al's No. 1 Coker, 2,900 varas along S line of grant from river and 1,700 varas N at R/A, R. De La Pena Sur.
S.D. 527 ft.

FREESTONE COUNTY

Amerada Pet. Corp.'s No. 1 Burk, 851 ft. S 125 ft. W of river, E. G. Rector Sur.
T.D. 4,025 ft. in oil sand; comp. Mar. 15, 1935; tested 22 hrs. and made 130 bbls. through 14/16-inch choke or 8¼ bbls. in 30 mins.; Tubing pres. 920 lbs.; csg. pres. 1,250 lbs.
Hoover et al's No. 1 McFall, 150 ft. S and W lines, S. Garrison Sur., E of Mexia.
Location.
Clark & Cowden's No. 1 W. H. Goolsby, T.D. 4,428 ft. in SW sand; top Woodbine 4,374 ft.; dry and abnd.

GREGG COUNTY

O. T. Clark's No. 1 Williams, 2,100 ft. from S and 2,400 ft. from W of D. Hill Sur., 3 miles NE of Longview.
D.S. test; tested dry; W.O.

HENDERSON COUNTY

Great States' No. 1 Ansley, 1,724 ft. W and 300 ft. S of SE cor. of M. Matthews Sur., N. H. T. Thompson Sur.
T.D. 1,627 ft. in shale; S.D. repairing wtr. line.
Taubert & McKee's No. 1 M. T. Dobbs, NW cor. of east Dobbs 100-ac. tract, 4 miles E of Malahoff and S of Railroad, George Aldrick Sur.
T.D. 4,048 ft.; pulling liner; will set 100 ft. csg. on bottom.
H. M. Wilson's No. 1 fee, 970 varas S of NE cor. of 942-ac. tract, 5 miles N of Malahoff.
Derrick.

HILL COUNTY

Humble O. & R. Co.'s No. 1 Holderman, 1,667 ft. from E and 750 ft. from N line of tract in C. Sullivant Sur., 1 mile W of Mt. Calm.
T.D. 3,398 ft. in shale; top Georgetown lime 1,370 ft.; Fredericksburg 1,590 ft.; Glen Rose 1,885 ft.; Travis Peak 2,668 ft.; El. 659 ft.; standing.

HOPKINS COUNTY

D. A. Hale et al's No. 1 L. M. Hall, 200 ft. from N and E lines of 70-ac. tract, 1 mile SE of Miller Gros. A. Caro Sur.
Top Austin 2,728 ft.; drlg. 2,779 ft. in Austin.

HUNT COUNTY

Cauble & Thompson's No. 1 Reed, 330 ft. N of northerly NE cor. of C. B. Payne Sur., but in F. Thweatt Sur., 3 miles SE of Greenville.
Core 3,250-56 ft.; rec. 6-in. in sandy shale; coring ahead; no shows.
Shawver et al's No. 1 Phillips, 1,200 ft. E of Winan's No. 1 Phillips, University Lands Sur., 2 miles W of Commerce.
Elev. 522 ft.; T.D. 1,617 ft.

KAUFMAN COUNTY

Germany et al's No. 1 Clark, 951 ft. N and 1,000 ft. W of tract, S. Eden Sur.
T.D. 1,780 ft.; shale; S.D.
Murry & Emerson's No. 1 G. W. Martin, 1,660 ft. from W and 250 ft. from N of 140-ac. tract, from W. L. C. Butler Sur., 2 miles NE of Kemp.
S.D. 27 ft.
L. P. Kean's No. 1 J. B. Hunter, R. Sowell Sur., 300 ft. from SW and 150 ft. from SE of 50-ac. tract, 4 miles S of Terrell.
Drlg. 3,194 ft.

LIMESTONE COUNTY

J. Edward Mills' No. 1 Hunt, 200 ft. from N, 350 ft. from W line 34.75-ac. tract, Israel Wood Sur., 3 miles NE of Kosse.
Pulling csg.; T.D. 3,637 ft.
C. F. Carter's No. 1 Dean, 660 ft. from SE and 330 ft. from SW lines of 75-ac. tract, P. Valella Sur., 3½ miles SW of Mexia.
T.D. 1,758 ft.; shale; bailing to test.
Crawford's No. 1 Vol DeLong.
T.D. 2,807 ft.; still burning.
Doughtry et al's No. 1 S. Welch, 150 ft. from NW and 900 ft. from NE of 77.64-acre tract in A. Varilia Sur., 4 miles W of Groesbeck.
T.D. 2,810 ft.; S.D. for fuel.
Magnolia Pet. Co.'s No. 28 Boyd, 300 ft. NE of No. 26 (Wortham Field).
Loc. abnd.
Pure Oil Co.'s No. 6-S Ross, 1,500 ft. from N and 400 ft. from E of H. Ross Sur. (Mexia Field).
T.D. 816 ft. in sandy shale; testing.

NACOGDOCHES COUNTY

Morrow et al's No. 1 C. B. Watkins, 150 ft. from N line and 330 ft. from NW lines of 160-ac. tract, 3 miles S of Caro, H. Y. Bailey Sur.
Chalk 3,392-3,750 ft.; drlg. 3,801 ft.
L. & G. Oil Co.'s No. 1 Z. Rambiln, 900 ft. N and 330 ft. W of SE cor. of tract and survey, J. Simpson Sur., 12 miles NE of Nacogdoches.
T.D. 3,408 ft.; S.D.

NAVARRO COUNTY

Bennett Brothers' No. 1 T. E. Stewart, 150 ft. from NE line of lease, 10 miles SW of Corsicana, Wm R. Bowen Sur.
T.D. 1,126 ft.; S.D.
R. B. Codding et al's No. 1 Lela Kent, 450 ft. from S line and center of N and S lines of lease, 3 miles NE of Chatfield, C. B. Emmons Sur.
S.D. 1,340 ft.
W. J. Keeling et al's No. 1 J. F. Rushing 484 ft. from N line and 150 ft. from W line of 184-ac. tract, 6 miles SW of Richardson, Henry Ford Sur.
T.D. 2,881 ft.; bad csg.; will reset.
McCullough et al's No. 1 C. Berry, 330 ft. from SE cor. of 35-acre tract, 1 mile W of Dawson, William Moss Sur.
S.D. 625 ft.; arranging to resume drlg.
McGlothlin's No. 1 Dobbin, 150 ft. W and midway from N and S lines of 138-ac. tract, E. Lowry Sur., 3 miles N of Corsicana.
T.D. 2,102 ft.; core 2,096-99 ft.; rec. 8-inch in sandy conglomerate; 8ft. soft brown sand, odor and stain; core 2,049-2,102 ft.; not pulled; S.D.; curing titles.
McGlothlin et al's No. 1 Barnett, 1,320 ft. N and 150 ft. W of 355-ac. tract, Elisha Powers Sur.
Elev. 345 ft.; T.D. 3,920 ft.; blue shale; comp. Mar. 9; dry and abd.
Wiggins et al's No. 1 Donoho, 450 ft. from N and 1,101 ft. from E lines in John Couple Sur., SW of Corsicana.
T.D. 1,400 ft.; S.D.

RED RIVER COUNTY

Dinger's No. 1 W. T. Norris, 1,000 ft. from S and 1,900 ft. from W of 400-ac. tract, Jos. Guest Sur., 1 mile S of Detroit.
Set csg. 1,250 ft.; W.O.C.
Joiner's No. 1 D. Rust, C. C. Wilborn Sur., 234 ft. N and 254 ft. W of most southerly SE cor. of Sur., just south of Avery.
Moving in rig.

RUSK COUNTY

Brusk's No. 3 Jeff Phillips, 150 ft. from N line of survey and 700 ft. from W line of 100-ac. tract, 4 miles SE of Minden, N. Villaria Sur.
T.D. 3,673 ft.; dry and abnd.
Ben Lamb's No. 1 H. Leath, 330 ft. out of NW cor. of 185-ac. tract in L. J. Dooley, S.D. 3,837 ft.
Richardson's No. 1 Wood.
Derrick.

SMITH COUNTY

Cloud et al's No. 1 Dendall, 330 ft. from S and W of 55-ac. tract, J. Williams Sur., 3 miles E of Van Field.
T.D. 1,650 ft.; Midway shale; S.D. for boiler.
Dr. Garland's No. 1 Bartlett, 330 ft. out of SE cor. of R. G. Steeart Sur., 1 mile SE of Jamestown, ½ mile E of Cloud.
Drlg. 2,500 ft.
W. R. Harrison's No. 1 Rushing, J. Herring Sur. (O.W.D.D.).
T.D. 4,330 ft.; S.D.; will P.B. and test again.
Peveto-Howze et al's No. 1 F. J. Watson, 150 ft. out of NW cor. of 75-ac. tract, Oliver Anderson Sur.
Top soft Pecan 3,550 ft.; hard 3,570 ft.; drlg. 4,160 ft. in chalky shale; el. 574 ft.
Sun Oil Co.'s No. 1 Longley & Reeves, Jonathan Lindley Sur., 330 ft. out NW cor. 151.45-ac. tract, 5 miles NE Chappel Hill.
Location.

TITUS COUNTY

S. Rotondi's No. 1 Lillianstun, 1,200 ft. E from NW cor. of J. Bodt Sur. and 330 ft. N, but in W. H. Crawford Sur., 5 miles NE of Talco.
Elev. 301 ft.; derrick.

VAN ZANDT COUNTY

Delcambre et al's No. 2 Crim, 400 ft. from S and 150 from E lines, Nacogdoches Co. School Lands.
T.D. 1,327 ft.; C.O.
Green and Winn's No. 1 Eaton, 330 ft. out of most westerly SW cor. of J. Wilson Sur., 2 miles SE of Martin.
T.D. 2,919 ft.; green sandy shale; 7-in. 2,-800 ft.; core 2,856-69 ft.; rec. 4 ft. red beds; 4 ft. sand, and 1 ft. good oil sand; W.O.C.
J. Beren et al's No. 1 Bryant, 453 ft. N of same operator's dry hole, Nacogdoches County School Land Sur.
W.O.S.R. 1,325 ft.
Beren et al's No. 2 Palmer, 544 ft. from S and 686 ft. from E of 69.5-ac. tract, Nacogdoches County School Land.
T.D. 1,324 ft.; tested slight show oil; waiting on power.
Miller et al's No. 1 J. M. Palmer, 150 ft. from S and E lines of 69-ac. tract, Nacogdoches County School Land Sur.
C.O. 1,192 ft.
M. Rouch et al's No. 1 Bearden & Palmer 150 ft. out of SE cor. of 61-ac. tract, Nacogdoches C.S.L.
S.D. 1,237 ft.

WOOD COUNTY

Hill & Hill's No. 1 J. J. Phillips, 330 ft. from N and E, James M. Moore Sur., 5 miles S of Winnsboro.
Moving in material.

Texas Panhandle Wildcats

Week Ending March 16

CARSON COUNTY

McClintock et al's No. 1 Jordan, 660 ft. N, 413 ft. W Sec. 105, Blk. 4, I.&G.N. Sur.
S.D. 3,123 ft.; 200 ft. oil in hole and est. 1,000,000 ft. of gas.
McGill's No. 2 Cooper, 330 ft. from S and 990 ft. from W of N½ of SE¼ Sec. 4, Blk. 9, I.&G.N. Sur.
Drlg. 1,211 ft.
Robert Watchorn's No. 1 Eller, 330 ft. from S and E lines of W½ of SE¼ of Sec. 9, Blk. 7, H.&G.N. Sur.
Building derrick.

CHILDRESS COUNTY

Humble O. & R. Co.'s No. 1-A Smith, 1,-288 ft. S and 1,407 ft. W, Sec. 14, Blk. 9, H.&G.N. Sur.
Drlg. 2,242 ft.
Watchorn O. & G. Co.'s No. 1 Low, C NW SE¼ Sec. 417, W.&N.W. Sur., S of Kirkland.
Drlg. 2,910 ft.

COTTLE COUNTY

Texas Co.'s No. 7 Lee K. Johnson, 1,950 ft. W of W line of Sec. 35, Blk. L, S.P.R.R., Foard County, and 500 ft. N of Anglin Sur.
Drlg. 3,253 ft.

DALLAM COUNTY

Eben Warner's No. 1 Jarboe, 1,520 ft. from S line, 415 ft. from W line, Sec. 2, B.&B. Sur.
S.D. 3,200 ft.; may abandon.

GRAY COUNTY

Cambrian Oil Co.'s No. 1-B Saunders, 330 ft. N and E of S½ of NE¼ Sec. 10, Blk. 4, B.S.&F. Sur.
Drlg. 2,440 ft.
Champlin O. & R. Co.'s No. 1 Taylor, 330 ft. from S and W of Sec. 6, Blk. 2, H.& G.N. Sur.
Moving in material.
Clayton et al's No. 1 Taylor, 330 ft. N and W of NE¼ Sec. 51, Blk. B-2, H.&G.N. Sur.
Drlg. 2,800 ft.

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Head, Department of Geology and Mineralogy, University of Minnesota

1931 edition; 736 pages; 435 illustrations

L. G. E. Bignell, Petroleum Engineering Editor, The Oil and Gas Journal, says in his review of this book:

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This book should find a place in every oil man's library, for it will serve as a ready reference to many geological problems that will come up in the course of his work, and also as a means of securing general geological data upon most of the important fields in this and foreign countries.

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THE OIL AND GAS JOURNAL

Tulsa, Oklahoma

Warner's No. 1 Taylor, 330 ft. N and W of SE¼ Sec. 8, Blk. 3, A. W. Wallace Sur.
Drlg. 340 ft.

Irish-American Oil Co.'s No. 1-B Morse, 990 ft. S and 330 ft. E, W½ NE Sec. 54, Blk. 25, H.&G.N. Sur.
Drlg. 2,725 ft.

Jeffries' No. 1 Sailor, 330 ft. from N and E of E½ of NW¼ Sec. 31, Blk. 3, I.&G.N. Sur.
Rigging up rotary.

McLaughlin et al's No. 1 Baggerman, 330 ft. from S and E of NW¼ Sec. 64, Blk. 3, I.&G.N. Sur.
Rig.

Plains Holding Co.'s No. 1 Morse-Gulf, 33' ft. S and W, Sec. 57, Blk. 25, H.&G.N. Sur.
Material.

Shell Pet. Corp.'s No. 1 Haggard, 330 ft. S and E of NW¼ Sec. 112, Blk. 3, H.&G.N. Sur.
T.P. 3,202 ft.; T.D. 3,249 ft.; shot with 120 qts. from 3,200-49 ft.; swbd. 115 bbls. in 8 hrs.

Southern Pet Explr. Co.'s No. 1 Barrett, 330 ft. S and W lines of SW¼ of NW¼ of Sec. 104, Blk. 3, I.&G.N. Sur.
Fishing tools 2,255 ft.

Texas Co.'s No. 2-C Taylor, 330 ft. from N and E of E½ Sec. 52, Blk. B-2, H.&G.N. Sur.
Drlg. 1,076 ft.

Vulcan Oil Corp.'s No. 1-A Kinnard, 1,180 ft. from N and 150 ft. from W lines of E½ of SW¼ of Sec. 41, Blk. 25, H.&G.N. Sur.
Building derrick.

HUTCHINSON COUNTY

Huey et al's No. 1 Christian, 220 ft. from S and 330 ft. from W, Sec. 32, Blk. Y, A.&B. Sur.
T.D. 3,175 ft.; 900 ft. wtr. in hole; P.B. to 3,100 ft.; C.O.

Stinnett Oil Co.'s No. 1 Starnes, 330 ft. from N and 275 ft. from W of E½ of NW¼ Sec. 22, Blk. M-23, T.C. Ry. Sur.
Rigging up.

Texilvania Oil Co.'s No. 1 Thompson, 440 ft. N and 2,735 ft. E. Sec. 15, Blk. M-23, T.C. Sur.
T.D. 305 ft.; driving 12-in. csg.

MOORE COUNTY

Sunray and Barnsdall Oil Companies' No. 2 Jones, 330 ft. from N and W of E½ Sec. 164, Blk. 3-T, T.&N.O. Sur.
Drlg. 3,030 ft.

Texoma Nat. Gas Co.'s No. 1-P Moore, 2,310 ft. S and 330 ft. E of W½ Sec. 14, Blk. 44, H.&T.C. Sur.
Drlg. 3,160 ft.; 10,400,000 ft. of gas 2,971-3,160 ft.

OCHILTREE COUNTY

U. S. Oil Corp.'s No. 1 W. R. Norris, 330 ft. S and 990 ft. E, Sec. 212, Blk. 43, H. &T.C. Sur.
Rigged up.

RANDALL COUNTY

English et al's No. 1 Oxnard, 350 ft. from N and 1,320 ft. from E lines of NE¼ Sec. 85, Blk. 2, A.B.&M. Sur.
S.D. 5,620 ft. for csg.

WHEELER COUNTY

C. & H. Drlg. Co.'s No. 1 Binkley, 330 ft. from S and W lines of NE¼ of Sec. 25, Blk. 24, H.&G.N. Sur.
Rig.

J. G. Cloud's No. 1 Tinley, 990 ft. from N and W of NE¼ Sec. 26, Blk. 24, H.&G. N. Sur.
Rigging up machine.

Dumar O. & G. Co.'s No. 1 Atkins, 660 ft. from N and W of E½ Sec. 49, Blk. 23, H.&G.N. Sur.
Drlg. 1,415 ft.

Johnson et al's No. 1 Pryor, 330 ft. N and E of E½ NE¼ Sec. 48, Blk. 13, H.&G.N. Drlg. 330 ft.

Martin & Dubose's No. 1 Schwarting, 330 ft. from S and 990 ft. from W lines of SE¼ of Sec. 53, Blk. 13, H.&G.N. Sur.
Location.

Smith Bros.' No. 1 Johnson, 330 ft. N and W, Sec. 34, Blk. 24, H.&G.N. Sur.
Drlg. 2,365 ft.

Smith Bros.' No. 1 Massey, 660 ft. from N and W lines of Sec. 14, Blk. 24, H.&G.N. Sur.
T.D. 1,981 ft.; pulling big pipe.

Smith Bros.' No. 1 Setter, 330 ft. from N and E of NW of NE¼ Sec. 33, Blk. 24, H.&G.N. Sur.
Drlg. 360 ft.

Southwest Texas Wildcats

(Continued from Page 137)

E line of 185-ac. tract in S. Y. Reams Sur.
Drlg. 3,800 ft.

GUADALUPE COUNTY

C. W. DeFreest's No. 1 Henry Beck, 502 vrs. from NW line, 150 vrs. from N line, Malpaz Sur.
T.D. 420 ft.; no report.

A. D. Locke's No. 1 Lowman, 210 ft. from SE and SW lines of 2,500-ac. tract in C. Campbell Sur.
Drlg. 1,695 ft.

J. S. Suttle's No. 2 Baenziger, S of Seguin. Old well; R.U. to W.O.

Suttle et al's No. 1 Baenziger.
S.D. 2,153 ft.

Seidemann et al's No. 2 Seidemann, 400 ft. from NW line, 360 ft. from NE line of 147.5-ac. tract, Esnaurrizer Sur.
T.D. 1,600 ft.; no report.

HIDALGO COUNTY

D. & D. Oil Co.'s (Clay, Spencer & Hood) No. 1 Brooks & Showers, 330 ft. N and E lines of Lot 4, Blk. 26, Por. 79-80.
Drlg. 3,525 ft.

Maxwell-Young's No. 1 King, 175 ft. N and E lines of Lot 8, Blk. 11.
T.D. 875 ft.; standing.

Downey & Morton's No. 1 Daskom, 450 ft. from E line, 55 ft. from S line of Blk. 34, Por. 45.
Drlg. 3,320 ft.

E. H. East's No. 1 Carter, 330 ft. from E line, 900 ft. from N line of Blk. 19, East Retama grant.
Standing 700 ft.

Nutex Oil Co.'s (Hankamer & Camp) No. 1 F. Rapp 511-ac. tract, Laguna Seca League.
Ready to resume drlg. at 125 ft.

Ernest Powell's No. 1 Geo. Moore, S end of 40-ac. tract, Porcion 42.
Drlg. 2,350 ft.

E. A. Showers' No. 1 Brocks & Showers, 660 ft. from N and E lines of Lot 11, Blk. 18, Porcion 79.
Drlg. 1,000 ft.

Union Sulphur Co.'s No. 3 American Rio Grande Land & Irrig. Co., 400 ft. from S line, 600 ft. from E line of Lot 2,032, Blk. 38, 200 ft. W of No. 2.
Drlg. 7,200 ft.

JIM HOGG COUNTY

French Oil Co.'s No. 1 Pena, 660 ft. from E line on lines of Blk. 41-42, Share 2, Sur. 574.
Spudded.

Miller & Pippin's No. 1 Yeager, 527 ft. S line, 150 ft. E line of Blk. 6, Sur. 30.
Drlg. 2,103 ft.

A. Edmiston's (Southwestern Dev. Synd.) (formerly John D. Norwood) No. 1 C. W. Hellen, 330 ft. N and W lines, Sur. 48.
Drlg. 1,600 ft.

Sun Oil Co.'s No. 1 Weil, 1,320 ft. from S and E lines, Sur. 13.
Drlg. 600 ft.

JIM WELLS COUNTY

P. M. Evans et al's No. 1 Cristler, C of Sec. 41, I.&G.N. Sur.
Coring sand 3,249 ft.

Joe Lundin's No. 1 T. C. Hewitt, SE cor. Sec. 51, McKinney & Williams Sur.
Rigging up.

Maer & Shira's No. 1 Schaeffer, 1,320 ft. E of NW cor. center of Blk. 15, of subdivision of ranch.
Derrick.

KARNES COUNTY

H. A. Pagenkopf's No. 1 T. J. McAda, 330 ft. from NE and NW lines of Tract C, Martinez Sur.
Coring top of Jackson 1,310 ft.

R. G. Tonkin's No. 1 Miss Olive Henke, 2,640 ft. from SW cor. N along W line, thence at R/A 330 ft., Seguin grant.
Abd. 2,830 ft.

KERR COUNTY

Meteor Oil Co.'s (Edminton & Walker) No. 1 Whitworth, 1,160 ft. from S line and 1,333 ft. from E line of Sec. 1,439, of the H.E.&W.T. Sur.
S.D. 950 ft.

Jeff Love and Eastland Oil Co.'s No. 5-E Jeff Love, 1,500 ft. SE of No. 1 and 1,530 ft. from SE cor. and 300 ft. from N line of Sec. 1,591.
Drlg. 4,510 ft.

LEE COUNTY

Jas. E. Pederson's No. 1 Turner, 1,860 ft. from N line, 150 ft. from E line of tract, David Hudson Sur.
T.D. 6,560 ft.; P.B. to 6,150 ft.; fishing for bailer.

Stowe & Schariach's No. 1 Otto.
T.D. 1,700 ft.; standing; moving in new boiler to deepen to Edwards lime.

LIVE OAK COUNTY

Arthur, Brunson & Hall's No. 1 W. P Howard, 150 ft. from W line, 2,400 ft. from N line of 200-ac. tract, in B. Ayers Sur.
T.D. 1,359 ft.; no report.

Baugh & McMillan's No. 1 Walton & Campbell, 1,500 ft. NE line and SE line of D. R. Fant Sur.
Drlg. 3,193 ft.; (corrected depth).

California Co.'s No. 1 Blankenship, 466 ft. from SW line, 2,000 ft. from SE line, A. A. Dunn Sur.
Abd. 4,902 ft.

Henderson Coquat's (Luling O. & G. Co.) No. 1 Rex, C of SW¼ of G.H.&H. Sur., Abst. 197, 8 miles S of Mileska.
Preparing to set surface csg. 1,200 ft.

Rowan & Hope's No. 1 L. R. George, 990 ft. from NW and SW lines of farm tract in John Ely Sur. No. A-171.
Moving in material.

Smith & Story's No. 1 G. T. Frederick, 1,650 ft. from railroad, 330 ft. from southern N line of 420-ac., Curry Sur.
Trying to clean hole at 4,271 ft.

J. O. Whittington's No. 1 Little, 1,320 ft. NE of S cor. of M. M. Shipp Sur., 330 ft. N of S line.
T.D. 5,314 ft.; R.U. to deepen.

MAVERICK COUNTY

Escher & Andrews' No. 1 Mathews, NW cor. of B. C. Flowers Sur.
Standing 615 ft.

McMULLEN COUNTY

Howard & Claunch's No. 4 Claunch, 1,800 ft. from SE line, 1,200 ft. from SW line of M. Hely Sur.
Set csg. 750 ft.; trying to complete as gas well.

Howeth & Swiger's No. 1 Rhodes, near C of Sec. 22, M. F. Lowe Sur.
Moving in material.

Points et al's No. 1 Fahler, 2,000 ft. from S line, 2,500 ft. from W line of 1,000-ac. tract, Pittuck Sur.
T.D. 603 ft.; no report.

Witherspoon Oil Co.'s No. 1 Lark, Blk. 110, Scrugham Sur.
Deepening to Yegua 1,190 ft.

MEDINA COUNTY

John Lind's No. 1 Jungman, 2,050 ft. from N line, 550 ft. from W line, J. Degat Sur.
Spudded.

Scoggins & Sanders' No. 1 L. W. Burrell, 150 ft. from E line, 1,750 ft. from N line of M. E. Gage Sur. 395.
S.D. 1,880 ft.

MILAM COUNTY

H. V. Pedersen's No. 1 Sandow (formerly C. F. Drake et al's No. 1 Standard Coal Co.) 970 ft. SW line, 1,700 ft. SE line of G. L. Johnson Sur.
C.O. 1,575 ft.

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(U. S. Patent 1,962,634 and others pending.)

Second Natl. Bank's No. 2 Ward, 700 ft. from SE line, 2,598 ft. from SW line, L. Taylor Sur.
S.D. 60 ft.

NUECES COUNTY

Magnolia Pet. Co.'s No. 1 S. Page, 190.8 ft. from W line, 196 ft. from N line of 75-ac. tract in Kinney Sur. No. 586, Sec. 8.
Drlg. 5,245 ft.

REAL COUNTY

H. J. Heartwell et al's No. 2 L. J Maby, 694 ft. from W line and 2,153 ft. from S line of A.B.&M. Sur. No. 175.
T.D. 2,837 ft.; preparing to resume drlg.

SAN PATRICIO COUNTY

Allied Minerals' No. 1-A Ramsey, 466 ft E, 220 ft. N of SW cor. of the North B. Giddings Sur. on a 1,000-ac. tract.
Sandy shale 2,642 ft.; moving in heavier rig; S.D.

Masterson et al's (Tom Graham) No. 1 Wurzbach, 330 ft. from W line, 4,350 ft. from S line of C. C. Hernsby Sur.
W.O.C. 500 ft.

Plymouth Oil Co.'s No. 1-C Welder, 10 mi. NW Sinton.
Drlg. 3,200 ft.

Stanolind O. & G. Co.'s No. 1 J. J. McMillan (Whitehurst), 165 ft. from W line, 990 ft. from N line of Lot 12, Fulton Pasture Subd., Fitzsimmons League.
Drlg. 4,725 ft.

STARR COUNTY

Armstrong, Emanuel & Adams' No. 1 S.C C.C., 330 ft. from S and E lines of Blk 57, Porcion 88-89.
Drilled plugs; running tubing 2,740 ft.

C. R. Borah's No. 1 A. Guerra, San Jose grant, 330 ft. from N and 150 ft. from E lines of Sec. 6 (NE part of county).
T.D. 2,740 ft.; no report.

John H. Clopton's No. 1 Roos, 13,155 ft. N of Highway 4, along E line of Por. 92, 3,300 ft. N, 80 deg 45 min. W.
T.D. 4,334 ft.; drlg. in sidetracked hole at 3,850 ft.

John H. Clopton's No. 1 Dioncia Lopez de Tijerina, Blk. 4, Tract C-14, Porcion 80.
Drlg. 1,725 ft.

Crawford et al's No. 1 Hicks et al, 150 ft SE and NE line of NW, Perdernal grant.
S.D. 1,615 ft.

Dalnwood Oil Co.'s No. 1 Guerra, 5,280 ft W line and N line of Share 26, Porcion 70-71-72.
Location.

Geo. Lacy's No. 1 Abney, Porcoin 99; ½ mi. W of Vernon's No. 1.
Rigging up.

F. D. Vernon's No. 1 G.L.&C.C.O., 330 ft. midway between N and S lines of Lot 8, Porcion 100.
S.D. 2,795 ft.

Morris & Bryan's No. 1 Hicks & Hicks, 660 ft. NE line, 2,000 ft. SE line of 500-ac. tract, Pedernal grant.
T.D. 1,103 ft.; no report.

Conroe Drlg. Co.'s No. 1 Guerra, 330 ft. from NE and SE lines of Blk. 35, J. N. Crawford Subd., Por. 56. Jurisdiction of Mier
T.D. 2,225 ft.; drill pipe stuck; P.B. 1,000 ft.

Dale Sneed's No. 1 Y. and V. Guerra, 330 ft. W line of Por. 68, 330 ft. S line of 1,000-ac. block of N end of Por. 92, in Por. 68.
Standing 330 ft.

R. H. Vice's No. 1 Carruth, 3,690 ft. from S line, 3,300 ft. from W line, Share B-1, Por. 91-92.
S.D. 4,016 ft.

TRAVIS COUNTY

Anderson's No. 1 A. D. Beham.
T.D. 510 ft.; no report.

D. Prewitt's No. 1 Ed Peterson, 150 ft. from SE and SW lines of tract, L. Kimbro Sur.
Rigging up; S.D.

J. A. Stubbs' No. 1 Julius Kerlin, 530 ft. SW line, 450 ft. NW line of 123-ac. tract in I. Lindsay Sur. No. 61.
S.D. 1,135 ft.

WEBB COUNTY

Frank E. McMillan's No. 1 Bruni, 330 ft. from S and E lines of SW¼ of SE¼ of Sur. 77.
Drlg. 2,570 ft.

Payne et al's No. 1 Heggterp, Blk. 5, Sur. 1,110, N of Oilton.
S.D. 600 ft.

Arthur H. Wray's No. 1 Geo. Stuempke, Share 1, Brewster pasture, Galan grant.
Drlg. with spudder 600 ft.; no report.

WILLACY COUNTY

Daniel et al's (South Texas Dev. Co.) No. 1 Armendias, 1,500 ft. W of Arroya Colorado River, 1,200 ft. N of S line of Tract 4.
Drlg. 4,890 ft.

WILLIAMSON COUNTY

Gault & Mimms' No. 1 H. V. Seggren, 1,000 ft. from W line, 300 ft. from S line of 450-ac. tract, Bevil Sur.
T.D. 340 ft.

Goff et al's No. 1 Timmerman, Cartwright Sur.
Drlg. 318 ft.

Johnson & Ray's No. 1-B M. Oxford Smith, 600 ft. S of No. 1-A in S. Williams Sur.
S.D. 20 ft.

J. Morgan Russell's No. 1 Nelson, 1,150 ft. S line, 1,115 ft. E line of John L. Justice Sur. No. 2.
S.D. 894 ft.

ZAPATA COUNTY

F. H. Crow et al's No. 1 Daniel Ysaguirre, 330 ft. out of SW cor. Share 1, Porcion 14-15-16, D. Ysaguirre tract.
Location for 3,500-ft. test.

Danvers & Harrison's No. 1 D. A. McAskill, near N line of county.
Set and cmtd. csg. 20 ft.

H. & M. Oil Co.'s (Virginia Hardee) No. 1 Slator, 514 ft. from SW line, 150 ft. from SE line of Blk. 65, Borrego grant.
Standing 22 ft.

Joe Palmer's No. 1 J. M. G. Martinez, 150 ft. SE and SW line, Blk. 27, Sur. 434.
Standing 1,445 ft.

Southwest Texas Proven

Week Ending March 23

CAESER—BEE COUNTY

Caesar Oil Co.'s No. 3 R. E. Miller.
T.D. 3,034 ft.; abd.

Luling O. & G. Co.'s No. 6-B Ruhman, 661 ft. from NW line, 550 ft. from NE line of 163-ac. tract, Hodge Sur.
T.D. 3,067 ft.; I.P. 100 bbls. per hr.

DIRKS—BEE COUNTY

Conservative Oil Co.'s No. 1 Harris, 330 ft S of N line, 330 ft. W of E line of 30-ac. tract, J. L. Dugat Sur.
Rigging up.

Navarro's (Dirks Bros.) No. 1 J. E. Roth, 280 ft. from N line, 330 ft. from W line of S½ of NW¼ of Sec. 7.
T.D. 3,914 ft.; P.B. to 2,800-ft. sand.

PETTUS—BEE COUNTY

United Prod. Co.'s No. 49 Ray, 30 ft. from N line, 1,320 ft. from W line of W. J. Porter Sur.
T.D. 3,714 ft.; comp. as dry gas well; 540 lbs. closed-in pressure; 475 lbs. csg. pressure; 450 lbs. tubing pressure.

TULETA—BEE COUNTY

Blanco Oil Co. and Buchanan's No. 3-A Perez, 660 ft. from N line, 330 ft. from E line of SE¼ Sec. 9.
Setting csg. in sand 3,875-91 ft.

Edwin M. Jones' No. 12 Robinson, 330 ft. from S and W lines of 160-ac. tract.
T.D. 4,500 ft.; P.B. to 3,938-53 ft.; I.P. 60 bbls. per day.

Edwin M. Jones' No. 13 Robinson, 990 ft. from S and W lines of Sec. 5.
Rigging up.

Edwin M. Jones' No. 14 Robinson, 900 ft. from S and E lines of Sec. 5.
T.D. 3,954 ft.; I.P. 350 bbls. per day; 900 lbs. tubing pressure; 1,200 lbs. csg. pressure.

Edwin M. Jones' No. 15 Robinson, Sec. 5.
Rigging up.

Heyser, Heard & Walton's No. 1 fee, 50 ft. from the No. 1, SE¼ of Sec. 8.
Drilled plugs; lost swab in hole 3,100 ft.

Houston Oil Co.'s No. 6 Ed Strauss, C of Lot 11, SW¼ Sec. 9, W offset to No. 5.
T.D. 3,992 ft.; I.P. 4 bbls. per hr.; ¼-in. choke; 800 lbs. tubing pressure.

Houston Oil Co.'s No. 10 Ed Strauss, C Lot 5 from SE¼ of Sec. 9, Hahl Subd., J. M. Uranga grant.
T.D. 3,988 ft.; I.P. 13 bbls. per hr.; ¼-in. choke; 825 lbs. tubing pressure.

Mills Bennett's No. 3 Tuleta Merc. Co., 330 ft. from N line, 990 ft. from W line of SW¼ of Sec. 10.
Set csg. in sand 3,923-28 ft.; W.O.C.

Mills Bennett's No. 3 Harris, 990 ft. from W line, 330 ft. from S line of Sec. 9.
Drlg. to Yegua; depth not given.

Southwest Exploration Co.'s No. 1 Heyden & Bruckham, C of farm tract, 330 ft from N and W lines of Sec. 20, Uranga grant.
Rigging up.

Tuleta Oil Co.'s No. 6 Skinner & Harris, 660 ft. N of No. 5, 330 ft. from W line.
Perforating 3,928-32 ft.; to complete.

Wrightsman Oil Co.'s No. 1 Kimball, 1,200 ft. from NW line, 1,500 ft. from NE line, S. Winship Sur.
Standing 275 ft.

VON ORMY—BEXAR COUNTY

Jack Crouch's No. 5 Hoch, 330 ft. S of No. 4, Baerera Sur. No. 58.
S.D. 250 ft.

Richcul Oil Co.'s No. 1 Kohler, 1,000 ft from N line, 155 ft. from E line of J. Vogt 96.5-ac. tract in J. M. Baerera Sur. No. 58.
S.D. 1,370 ft.

Richcul Oil Co.'s No. 1 Weilbacker, 155 ft from E line, about 2,250 ft. S of highway in Jett Sur.
S.D. 665 ft.

GOVERNMENT WELLS POOL—DUVAL COUNTY

Mills Bennett's No. 1 W. R. Peters, 330 ft. from S and E lines of NW¼ of Sur. 178.
Drlg. 2,985 ft.

Geo. E. Buck's No. 1 Norton, 330 ft. from N and W lines of SE¼ of SW¼ of Sur. 62.
T.D. 2,378 ft.; I.P. 25 bbls. per day.

Central Producers' No. 3 Wendt, 330 ft. from S line, 310 ft. from E line of NE¼ Sur. 43.
Drlg. 1,200 ft.

H. H. Coffield's No. 5 Wendt, 330 ft. from S line, 310 ft. from E line of NE¼ of Sur. 43.
T.D. 2,311 ft.; I.P. 20 bbls. per hr.; ⅝-in. choke.

Edgington & Murray's No. 2 C. W. Hahl, 330 ft. N and E lines, Blk. 16, Sur. 250.
T.D. 2,370 ft.; I.P. 15 bbls. per day.

Gov. Wells Oil Co.'s No. 11 State, 1,650 ft. from E line, 330 ft. from N line, Sur. 60.
T.D. 2,293 ft.; I.P. 25 bbls. per day.

Gov. Wells Oil Co.'s No. 16 State, 330 ft. from S and E lines of SW¼ of SE¼ of Sur. 48.
Drlg. 1,750 ft.

Frank Gravis et al's No. 1 C. W. Hahl, 330 ft. from S and E lines of NE¼ of Sur. 365.
T.D. 2,553 ft.; swbng. about 90% S.W.

L. & R. O. & G. Co.'s No. 1 Hahl, 330 ft. from S and E lines of NE¼ of Sur. 63.
Coring after testing S.W. 2,726 ft.

Magnolia Pet. Co.'s No. 1 C. W. Hahl, 330 ft. from N and E lines of Sur. 67.
T.D. 2,945 ft.; P.B. to 2,721 ft.; W.O.C.

Magnolia Pet. Co.'s No. 5 Hahl-Norton, in Sur. No. 61.
T.D. 2,330 ft.; I.P. 150 bbls. per day.

Magnolia Pet. Co.'s No. 14 Hahl-Southland, 330 ft. from E line, 990 ft. from S line of NW¼, Sur. 61.
Drlg. 2,000 ft.

Magnolia Pet. Co.'s No. 12 Wilson, 990 ft. from S line, 330 ft. from E line, Sur. 136.
Testing 2,315 ft.

Reynosa Oil Co.'s No. 3 Lundell, 330 ft. from S and E lines of NE¼ NE¼ of Sur. 60.
Spudded; (correction).

Salt Dome Oil Co.'s No. 5-B Moody, 330 ft.

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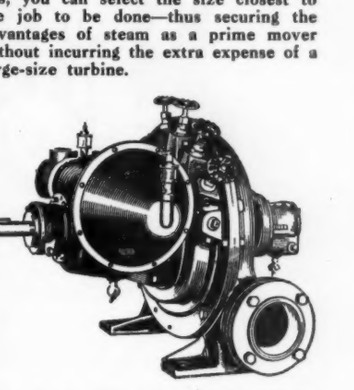

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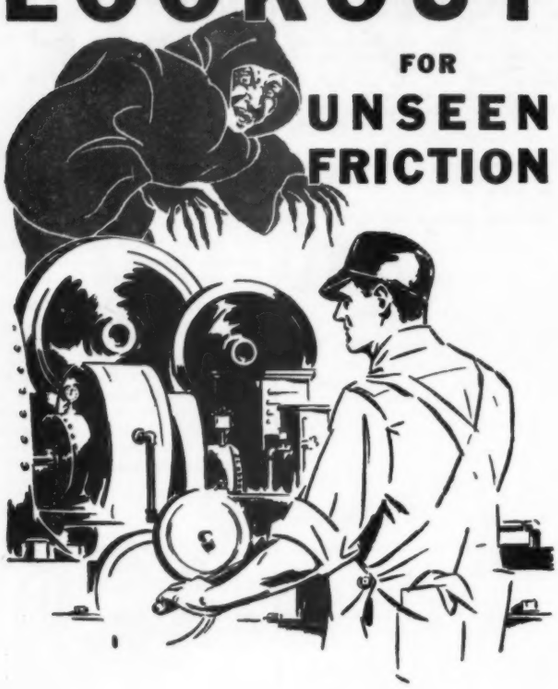

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from N and E lines of NE¼ NW¼ of Sur. 60.
Testing 2,389 ft.

San Diego Oil Co.'s No. 2 Heller, 200 ft. from S and W lines of SW¼ of SE¼ of Sur. 44.
Drlg. 2,220 ft.

Southwest Drlg. Co.'s No. 1 Luptack, 330 ft. from N and E lines of N 50 acres of E 100-ac. tract in SE¼ of Sur. 41.
Rigged up.

Texas Co.'s No. 2 Ruiz, 910 ft. from N line, 600 ft. from E line of S½ of Sur. 42.
Skidding derrick.

LOMA NOVA—DUVAL COUNTY

Humble O. & R. Co.'s No. 3 Ruiz, 330 ft. from W line, 2,735 ft. from S line of tract.
Derrick.

Magnolia Pet. Co.'s No. 7 Ruiz, 1,403 ft. from SW line, 330 ft. from SE line, Sur. 574.
Derrick.

NORTH KOHLER—DUVAL COUNTY

G. G. Mortiner's No. 2-B Peters, 2,310 ft. from W line, 330 ft. from N line of SW¼ of Sur. 196.
Rigging up.

DARST CREEK—GUADALUPE COUNTY

Grayburg Oil Co.'s No. 14 McKean, 700 ft. from No. 13.
Moving in rig.

LUCAS—LIVE OAK COUNTY

Houston Oil Co.'s No. 31 Cartwright, 1,010 ft. N of No. 30, J. Sandman Sur.
Set 7-in. csg. 5,234 ft.; W.O.C.

Lion Oil Ref. Co.'s No. 4 McNeil, 355 ft. due S of No. 1.
Drlg. 3,600 ft.

SAM FORDYCE—HIDALGO COUNTY

Alamo Drlg. Co.'s No. 2 Guerra, 232 ft. from N line, 330 ft. from E line of NW 12.5 acres of S 75 acres, of Tract 254, Por. 40.
T.D. 2,125 ft.; standing.

Bridwell's No. 2 Pena, 200 ft. from E line, 230 ft. from S line of Tract 277, Por. 40.
T.D. 2,755 ft.; I.P. 250 bbls. per day.

Double D Oil Co. and Harrison's No. 1 Lula George, 150 ft. from S and W lines of SW 20 acres of Tract 13, Porcion 41.
Drlg. loose gravel 100 ft.

Heep Oil Corp.'s No. 1 Lawrence, 226 ft. from N line, 241 ft. from E line of SE 5 acres of Tract 274, Porcion 39.
Drlg. 2,650 ft.

Luckey, Blocker & Bishop's No. 3 Francisco Guerra, 165 ft. from S line, 630 ft. from W line of SE 20 acres of Tract 254, Porcion 39.
Location.

Reed et al's No. 1 Smith, 164 ft. from W line, 133 ft. from N line of S 10 acres of NW 46.29 acres of Share B-3, Por. 41.
Spudded.

Reserve Oil Co.'s No. 4 Seabury.
S.D. 2,762 ft.

Skelly Oil Co.'s No. 1 Seabury, 330 ft. from S line, 230 ft. from E line of W 24 acres, Tract 256, Por. 38.
T.D. 2,800 ft.; I.P. 3 bbls. per hr.; 900 lbs. tubing pressure; ¼-in. choke.

Waite's (Scheafer & Mundy) No. 1 Tobasco, Ind. Dist., 25 ft. from N line, 210 ft. from E line of Tract 260, Por. 38.
Drlg. 1,550 ft.

Weekly Oil Co.'s No. 4 Smith, 1,000 ft. from N line, 165 ft. from E line of NE 34.43 acres, Tract 278, Por. 40.
T.D. 2,769 ft.; I.P. 75 bbls. per day; ⅛-in. choke; 240 lbs. tubing pressure.

Wheelock & Collins' No. 1 Seabury, SW cor. of SE 20 acres, Tract 256, Por. 38.
T.D. 2,787 ft.; perforated 2,768 ft.; completing.

HENNE-WINCH-FARISS—JIM HOGG COUNTY

Magnolia Pet. Co.'s No. 36-A Martinez, 330 ft. from S and E lines of Sur. 275.
Abd. 4,656 ft.

SANDIA—JIM WELLS COUNTY

O. W. Killam's No. 4 Wade, ¼ mile N of No. 3 Wade.
T.D. 4,850 ft.; P.B. to test 4,000-ft. sand.

Magnolia Pet. Co.'s No. 6 Seeligson, 660 ft. W, 330 ft. S of No. 3, Canales Sur. No. 20.
Drlg. 3,490 ft.

BURNEL—KARNES COUNTY

American Liberty Oil Co.'s No. 2 Belknap, 3,000 ft. from NW line, 340 ft. from NE line, Chas. Haynes Sur.
Drlg. 3,460 ft.

Luling O. & G. Co.'s No. 1 W. C. Boyce, 150 ft. from NW cor. of tract, J. Johnson Sur.
Moving in.

E. L. Smith Oil Co.'s No. 1 Steed, 330 ft. from NW and NE lines of 219.75-ac. tract, B.&B. Sur.
Rigging up.

KINGSVILLE—KLEBERG COUNTY

Fidelity Exploration Synd.'s No. 1 Vivian Kivlin, Sec. 4, Blk. 39, K.T.&I. Sur. on Vivian Kivlin lease.
Derrick up.

JACOB POOL—McMULLEN COUNTY

Kennon & Stephenson's No. 2 Lark, 150 ft. from N and W lines of Blk. 15, Scrugham Sur.
T.D. 1,038 ft.; I.P. 10 bbls. per day.

Longhorn, trustee's No. 4 Lark, Blk. 4 of the Scrugham Sur.
T.D. 1,035 ft.; trying to comp.

Loma Oil Co.'s No. 34 Jacob.
Abd. 1,090 ft.

Motes & Beddingfield's No. 4 Jacobs.
Set csg. to complete.

Motes & Beddingfield's No. 5 Jacobs.
Set csg. to complete.

Texas Pet. Co.'s No. 1 Wulf, 1,000 ft. from N line, 200 ft. from E line, Two Rivers Subd.
Spudded.

SINTON—SAN PATRICIO COUNTY

Humble O. & R. Co.'s No. 1 Welder, 2,400 ft. from N and E lines of 300-ac. lease.
Showing oil 6,095 ft.

ANGELITA—SAN PATRICIO COUNTY

Plymouth Oil Co.'s No. 2-B Welder, start at SW cor. of "B" lease, thence NW along the W line 2,100 ft., thence 350 ft. NE at R/A.
T.D. 6,859 ft.; comp. at 5,413 ft. for 2,000,000 ft. of gas; 1,700 lbs. tubing pressure; 1,800 lbs. csg. pressure.

Plymouth Oil Co.'s No. 3-A Welder.
Rigging up.

LOS OLMOS—STARR COUNTY

H. L. Curry's No. 1 Bass, 835 ft. E line, 2,522 ft. N line of Sur. 8, Por. 75-76-77.
Drlg. 1,400 ft.

J. P. Kennedy's No. 1 Kelsey-Bass, 200 ft. SE of No. 7 Kelsey-Bass in Blk. 7 of Porcions 75, 76 and 77.
Standing 710 ft.

BARBACOAS—STARR COUNTY

Merren Bond et al's No. 4 S.C.C.C., 330 ft. from N and E lines of S 20 acres of Blk. 24, of the Jeffries Lambeth Subd., Por. 89.
S.D. 4,212 ft.

RIO GRANDE CITY—STARR COUNTY

Goodwin et al's No. 1 Pena, 150 ft. from SE and SW lines of Share 80, Por. 81.
S.D. 1,450 ft.

R. M. Mitchell's No. 1 Salinas, 188 ft. from N line, 300 ft. from W line, Blk. 2, Share 39, Por. 80.
S.D. 1,000 ft.

Sioux Oil Co.'s No. 6 Goodrich, 150 ft. from S and W lines, Blk. 13, Tract 5, Por. 81.
Rigging up.

SAXET—NUECES COUNTY

Southern Mineral Corp.'s No. 4 Ocher, 1390 ft. S line and 417 ft. E line of Ocher 202.52-ac. tract in Sec. 8.
Derrick.

WEST COLE POOL—WEBB COUNTY

American Liberty Oil Co.'s No. A-14 Bruni, 781 ft. from S line, 330 ft. from W line, Sur. 6, Arispe grant.
T.D. 3,436 ft.; I.P. 18 bbls. per hr.; ¼-in. choke.

American Liberty Oil Co.'s No. 15-A Bruni, 418 ft. from NE line, 260 ft. from SE line, Blk. 40, Sur. 5.
Spudded.

Associated Oil Co.'s No. 2 Bruni, 330 ft. from NW and SW lines of tract, Sur. 7, Arispe grant.
Drlg. 1,900 ft.

Ross Barnhart's No. 1 de la Garza, 1,500 ft. from N line, 200 ft. from E line of Sur. 262.
T.D. 2,153 ft.; washing below 2,000 ft.

CarolinaTexas O. & G. Trust, Inc.'s No. 11 S. Benavides, 150 ft. from S line, 600 ft. from W line, Blk. 12, Sur. 683.
S.D. 3,816 ft.

Cole Pet. Co.'s No. 91 Benavides, 614 ft. from SE line, 927 ft. from NE line of Sur. 1.
Abd.; half S.W. 3,413 ft.

Cole Pet. Co.'s No. 92 Benavides, 330 ft. from N and E of E cor. of Callaghan Tract on Sur. 6.
Rigging up.

Highland Oil Co.'s No. 2 Bruni, 330 ft. from NW and NE lines of tr. in Sur. 7.
Drlg. 3,200 ft.

O. W. Killam's No. 1-A Bruni, 275 ft. from N line, 200 ft. from W line of Blk. 55, Brown Subd., Albercas grant.
T.D. 2,352 ft.; P.B. to 2,100 ft.; shooting at 2,100-13 ft.

O. W. Killam's No. 32 Bruni, 260 ft. from SE line, 418 ft. from NE line of Blk. 28, Sur. 8.
W.O.C. 3,425 ft.

O. W. Killam's No. 34 Bruni, 236 ft. from SW line, 330 ft. from SE line, Sur. 6.
Derrick.

Magnolia Pet. Co.'s No. 8-A Benavides, 159 ft. from N and E lines of NW¼ of NE¼ of Sur. 660.
Drlg. 2,300 ft.

Peerless-Seeligson's No. 2 Bruni, 940 ft. from NE line, 260 ft. from SE line Blk. 14, Sur. 5.
Drlg. sand 3,414 ft.

J. Elmer Thomas' No. 3 Gates, 1,950 ft. from E line, 900 ft. from N line, Sur. 22.
Abd. 399 ft.

J. E. Thomas' No. 6 Gates, 2,377 ft. from N line, 200 ft. from E line, Sur. 63.
Drlg. 300 ft.

Tide Water Oil Co.'s No. 1 Bruni.
Tested sand 3,391-3,405 ft.; showed hole full of oil and 125 lbs. pressure in 15 min.; setting csg.

Sun Oil Co.'s No. 3 Bruni, 260 ft. SE line, 418 ft. NE line of Sur. 5.
T.D. 3,440 ft.; I.P. 40 bbls. per day.

Sun Oil Co.'s No. 6 Bruni, 260 ft. from SE line, 418 ft. from NE line, Blk. 15, Sur. 5.
T.D. 3,433 ft.; P.B. to 3,428 ft.; W.O.C.

RYERSVILLE—WILLIAMSON COUNTY

Coffield & Lanning's No. 3 Heap, 200 ft. from N line, 225 ft. from W line of tract in White Sur.
Location.

R. R. Ogden's No. 1 Matteck, 150 ft. N and W lines of 108.5-ac. tract in White Sur.
Location.

GOPHER—ZAPATA COUNTY

O. W. Killam's No. 2 Bruni, 5,700 ft. from NW line, 2,615 ft. from NE line of Borrego grant.
Coring 2,045 ft.

JENNINGS—ZAPATA COUNTY

Texas Co.'s No. 64 Whitehead, 4,776 ft. from SE line, 19,556 ft. from SW line, Cerrito Blanco grant.
T.D. 1,223 ft.; I.P. 115 bbls. per day.

LOPENO—ZAPATA COUNTY

Alva J. Niles' No. 23 Trevino, 650 ft. from S line, 150 ft. from W line, Blk. 16, Sur. 413.
T.D. 1,241 ft.; I.P. 30 bbls. per day.

Alva J. Niles' No. 5-C Trevino, 150 ft. from E line, 156 ft. from N line, Blk. 15, Sur. 412.
Drlg. 700 ft.

Norden & Morris' No. 1 Vela, 1,320 ft. from NE line, 660 ft. from SE line, Blk. 6, Por. 26.
Drlg. plugs at 2,319 ft.

Venture Pet. Co.'s No. 1 I. Ramirix, 990 ft. from NE and NW lines of Blk. 1, Por. 18.
T.D. 2,349 ft.; I.P. 40,000,000 ft. of gas; 1,025 lbs. rock pressure.

drill stem
SAFETY
VALVES

Carried on the bottom of the Kelly Joint, the T-I-W Drill Stem Safety Valve serves as a blowout preventer to close the inside of the drilling string, removing all strain from and eliminating all danger of cutting out swivel, rotary hose and other connections. Valve has the same O. D. as a tool joint or pipe coupling, and is amply strong to stand hard drilling. Wherever a blowout preventer is used, a T-I-W Drill Stem Safety Valve should be used. Illustrated descriptive pamphlet on request.

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We don't do business this way, but there are lots of profit-making facts you should know about Baker Cement Equipment for the safe and permanent landing and cementing of your casing strings.

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BAKER OIL TOOLS, INC.

Among Gulf Coast Drilling Contractors

T. B. Cochran Drilling Co., Clarence Farris, superintendent, is drilling a well for the American Liberty Oil Co. in the Coleta Creek Field, near Victoria, Victoria County, and also has a rig running for the same company in the Bruni Field. Mr. Farris is making his headquarters in Victoria.

Cron & Gracey are drilling below 5,000 feet on a well for the Shell Petroleum Corp. at Whitecastle, La.; have three rigs running for the same corporation at Iowa, La.; have one rig running for the Texas Co. at Manvel; have one rig running for the Sinclair Prairie Oil Co. at Barbers Hill; have just completed a well for the Repollo Oil Co. at Eunice, New Mexico; are tubing a well for the Sinclair Oil Co. in East Texas; and have one well drilling for the Shell corporation at Roanoke, La.

Steen Drilling Co., on a well for Steinberger Petroleum Co. at Port Lavaca, Calhoun County, approximately 1 mile from the discovery well in the field, are coring the same sands as those found in the discovery well. Coring will be carried somewhat deeper, and a drill stem test made.

Rutherford Drilling Co. is drilling a well for the Stanolind Oil & Gas Co. in the Greta Field, Refugio County.

Carlisle & Williams, drilling for the Plateau Oil Co. in Bandera County, on a projected 6,500-foot wildcat test, have run into something really hard, according to reports trickling back to headquarters. Operators believe it to be hard sandstone similar to that encountered above the cap rock at High Island, although one of the boys opines that nine rock bits having been worn down in making 6 feet of hole, it must have been hard "grindstone" that was encountered. Despite continuous hard digging, the hole is drilling below 2,200 feet.

Edwards Drilling Co., which on an 8,500-foot test at Charenton Dome, St. Marys Parish, Louisiana, has experienced and surmounted an incredible series of unavoidable mishaps, is drilling below 7,600 feet at this time. The latest tangle resulted from a broken sheave carrying the overshot line for use with the wire line core barrel. When the sheave broke and scattered in pieces, the line came down, tearing out several girts and doing other damage.

Turnbull & Irwin are drilling below 5,800 feet on a wildcat in Fort Bend County, on the Herman Hospital estate 446-acre tract, for themselves and others. It is reported that the same contractors will re-enter and deepen their No. 1 Lynnott & Buffum, Liberty County, which was abandoned at 7,521 feet.

John Deering is rigging up to dig No. 2 Cruse in the Batson Field for the Batson Oil Co. and himself. He is also rigging up in the same field for the same operators on No. 1 Bullock. In the same field, he is drilling on No. 1 Hooks. Mr. Deering has abandoned the wildcat dug for Paul Kaiser and himself, in Wharton County, at 6,730 feet.

Talbot Drilling Co. has leased a rotary rig to the Tother Oil Co., which will drill in the Caesar Field in Bee County, below the town of Kennedy.

W. V. Bowles is rigging up to drill No. 9 Houston Oilfield Association for the Texas Co. at Manvel, and has one rig running for Bowles and Borsodi on their No. 2 B. E. Norvell in the Manvel Field. Bowles and Borsodi presently have two producing wells in the field.

Jordan Drilling Co. has derrick up on No. 1 Mary Milsap, Trinity Field, Houston County, for Boone Brothers of Houston. The company's heavy rig is to be put on this location, which is scheduled to go to 4,500 feet unless the Carrizzo sand is picked up and pays off. Company's smaller rig is being moved to an 80-acre lease for Woodley Petroleum Corp., and Boone Brothers which will be an offset to Humble's No. 6 Shaw in the Trinity Field. H. B. Jordan, president of Jordan Drilling Co., has closed a deal with Sterling Oil & Refining Co., which will drill a well on a 5-acre lease owned by Mr. Jordan in the Batson Field, lease being 165 feet wide and 1,390 feet long. Location is an offset on the west to the Cruze well of the Batson Oil Co. and John Deering.

Smith & McDonald have moved a rig in the Louise Field, Wharton County, to drill No. 3 Garrett for the Pure Oil Co. They have also moved on to drill No. 8 Ware in the Cayuga Field for the Tide Water-Texas Seaboard Oil Companies. In Rusk County, on No. 3-B Hale, contractors are waiting on cement to drill in for the Tide Water Oil Co. At Church Point, La., for the Avalon Oil Co., contractors are sidetracking below 6,700 feet. Three heavy rigs are drilling for the Superior Oil Producing Co. at Boscoe. Same contractors have just finished No. 1 Mrs. Carter at 8,697 feet for the Shell Petroleum Corp., at Roanoke, La., and rig is waiting for another location. Contractors have also finished No. 2 Stuart at Louise for the Pure Oil Co., and this rig is waiting on orders.

Not all of the hazards associated with supplying the demands of motorists for "five gallons of gas and a quart of oil" are confined to the drilling of oil wells—either by company crews or drilling contractors. In the Gulf Coast, especially, where geophysical crews precede the bulk of wildcat drilling activity, many difficulties and dangers are surmounted in defining the domes and structures on which wells are later drilled. The picture above, showing Charles Conner, of Independent Exploration Co., holding a sizeable diamond back rattlesnake encountered and killed in a Louisiana swamp, gives an inkling of what the geophysical boys go through—and there isn't much difference between being hit by a falling crown block and being bitten by one of these reptiles, if a man is miles from camp, not to mention a hospital. Picture furnished through the courtesy of J. W. Flude of the Independent Exploration Co.

Spring Is Here!

Regulars are in training—rookies are in doubt—spikes are tearing up the turf and Baker Wall Scrapers are scraping formations in a lot of wells!

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LONGVIEW - HOUSTON - LAKE CHARLES

Anahuac Well in Chambers County, Increases Production to 30 Barrels an Hour in Test

By F. L. SINGLETON
Gulf Coast Bureau, The Oil and Gas Journal

HOUSTON, Tex., Mar. 25.—After showing for a small well, when tested the latter part of last week, Humble Oil & Refining Co.'s No. 1 Middleton, east of Anahuac in Section 58, H.&T.C. Survey, northern Chambers County, definitely proved this prospect as one of major importance, when it increased its production from 12 bbls. per hour to 30 bbls., and on a 20-hour gauge it flowed 646 bbls. of 35.6 gravity oil through a three-eighths-inch choke, with tubing pressure 1,800 pounds and casing pressure 2,350 pounds, and is now shut in for lack of storage.

The test is producing from approximately 60 feet of Frio sand. It encountered its first saturation at 7,028 feet, and was tested two weeks ago at 7,052 feet and flowed 6 bbls. per hour, but due to the high gas-oil ratio, it was cored to its present depth of 7,088 feet, the majority of which was sand, the last 4 feet being shale. This discovery makes the eighth field for the Gulf Coast that is producing from depths below 7,000 feet, and adds considerable to the importance of deeper exploration in this district.

Two new locations made by Humble Oil & Refining Co. during the week assured the field of an early development program. Offsetting the producer to the west in Section 57, H.&T.C. Survey No. 1 J. J. Clark is located 466 feet north of the south line and 466 feet west of the east line. Southwest of the discovery, and a south offset to No. 1 J. J. Clark in Section 64, H.&T.C. Survey, the company located No. 2 Middleton 466 feet out of the northeast corner of the section.

The Humble Pipe Line Co. has made arrangements, and will start construction of a 6-inch pipe line from the discovery, to tie into the company's 6-inch line at Moss Bluff Field, Liberty County, located approximately 12 miles northwest. The company's line at Moss Bluff was constructed in 1930 and extends through the Barbers Hill Field in Chambers County to Humble Oil & Refining Co.'s refinery at Baytown, in Harris County.

Sun Oil Co.'s No. 1 Hamilton, approximately 6 miles southeast of the above test in Section 128, T.&N.O. Survey, has been abandoned at 9,055 feet in heaving shale.

Hastings Field

The Hastings Field, northeastern Brazoria County, received its second producer, which extended the producing limits of the field approximately 2,100 feet east. The extension was made by Stanolind Oil & Gas Co.'s No. 1 Miller, in the A.C.H.&B. Survey, which flowed 150 bbls. the first 11 hours, 7 per cent of which was wash water, through a one-quarter-inch choke, with tubing pressure 750 pounds and casing pressure 900 pounds closed in. The last 24-hour gauge ending March 22 it flowed 169 bbls. of 31.8 gravity oil through a one-eighth and one-sixteenth-inch tubing chokes, with tubing pressure 900 pounds and closed-in casing pressure 900 pounds. The well is bottomed in shale at 6,009 feet and is producing from 21 feet of Marginulina sand topped at 5,972 feet and bottomed at 5,993 feet. Seven-inch casing was cemented at 5,977 feet. It is practically on the same strike as the discovery, which indicates that production may be extended considerable distance in this direction. The company's No. 1 Steve Paul, approximately 2,100 feet south of the discovery is shut down for orders at a total depth of 5,700 feet. About the same distance north, the company was preparing to drill plug on its No. 1 Wooster. Nine and five-eighths-inch casing was cemented at 4,362 feet. Total depth is 4,378 feet.

Port Lavaca

Approximately 1,500 feet northwest of Steen Drilling Co.'s No. 1 Stanzel, the discovery well in the Port Lavaca area, Calhoun County, Steinberger Petroleum Co.'s No. 1 W. A. Shofner, in the M. Sanchez Survey, cored sand, showing gas and distillate from 6,137-51 feet and is coring ahead, without making a drill stem test. This is practically the same depth from which the discovery well is producing and it almost assures the test of making the same type of well that the discovery made. The discovery well was completed in November at a total depth of 6,158 feet for an initial production of 151 bbls. of distillate per day through a one-quarter-inch choke.

Lynchburg Area

T.S.&F. Oil Co.'s No. 1 J. B. Hine, located in the Lynchburg area, in the Arthur McCormick Survey, Harris County, was given a set back in its chances of making a producer from the Miocene sand at a total depth of 3,524 feet, when it started flowing water with a brackish taste, when tested the middle of the week. Considerable attention was given the test after it was reported to have topped a sand showing saturation at 3,508 feet. Disappointment was being registered at two other interesting wildcat tests in this county. Hill and Hill's No. 1 Wharton, Section 5, W.C.R.R. Survey, topped the Cockfield sand at 6,645 feet and is drilling in shale with sand streaks, below 7,023 feet. At this depth it is 378 feet in the Cockfield formation and its chances of making a producer now are very small. The third failure for the Eureka Heights area located northwest of Houston city limits, looms at Eureka Heights Oil Co.'s No. 1 Varner, located about 3,500 feet southeast of the discovery well, in the John Reinerman Survey. Late in the week it was drilling in shale below 7,600 feet and was checking over a hundred feet lower than the discovery. It will be carried to 7,800 feet before it is abandoned. The operators are mak-

STRAIGHTER HOLE
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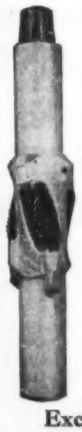

The shearing action of the three "barrel" shaped cutters, which are set at an angle, cut the walls of the hole cleanly and smoothly. This action keeps the hole free of any tight spots and allows closer tolerances between the hole and casing.

The use of the Sievers Reamer, assures increased drilling speed; better core recovery; decreased wear on drilling equipment; and lowered operating costs with greater safety.

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1412 Maury St., Houston, Texas

BRANCHES: Barbers Hill, Kilgore, Greta, Gladewater and Tomball, Texas; Lake Charles and Shreveport, Louisiana.

Wildcat Operations on Gulf Coast

Week Ending March 23

RACCOON BEND—AUSTIN COUNTY

Humble O. & R. Co.'s No. 2-X Grenau, 150 ft. from SE line, 150 ft. from SW line, Wm. Smeathers Sur.
10¾-in. csg. 1,159 ft.

Humble O. & R. Co.'s No. 14-X Woodley, 354 ft. W from No. 8, 418 ft. from easterly NE line, 375 ft. from most easterly N cor. of lease.
10¾-in. csg. 1,147 ft.; drlg. shale 3,450 ft.

Humble O. & R. Co.'s No. 7 Bellville, 550 ft. from NW line, 500 ft. from SW line, Wm. Smeathers & White Sur.
Top sand 3,940 ft.; 7-in. csg. cmtd. 3,926 ft.; I.P. 278 bbls. per day through ¼-in. choke.

Humble O. & R. Co.'s No. 7-X Wilson, 3,095 ft. from SW cor., 464 ft. at R/A from SW line, Wm. Harvey Sur.
T.D. 4,323 ft.; R.U. to pump.

BLUE RIDGE—BRAZORIA COUNTY

Trens-State Oil Co.'s No. 1 Blakely, Edward Drew Sur.
Prepare to drill plug; T.D. 3,663 ft.

San Jacinto Oil Co.'s No. 6 Blakely, 150 ft. N of No. 5 Blakely, Edward Drew Sur. Location.

DANBURY—BRAZORIA COUNTY

Shell Pet. Corp.'s No. 7 Blakely-Winston, 63 deg. 11 min. E. 5,540 ft. N. 26 deg 49 min. W. 200 ft. from SW cor. of Blakely-Winston 560-ac. tract, H.T &B. Sur.
T.D. 6,253 ft.; P.B. to 6,000 ft.

Shell Pet. Corp.'s No. 3 Haury, 800 ft. SE of No. 2 in line with No. 2 and No. 1 Blakely-Winston, H.&T.B. Sur. No. 13.
T.D. 7,168 ft.; making 10,000 ft. of gas daily.

DAMON MOUND—BRAZORIA COUNTY

Esco's No. 1-D Wisdom, 25 ft. from S and W lines of Blk. D. Lot 5. A. Darst Sur.
T.D. 1,509 ft.; prepare to pump.

Intercoastal Oil Co.'s No. 13 Wisdom, 150 ft. from NW line and 10 ft. from SW line of Lot "D," Blk. No. 51.
Spudded.

HASTINGS—BRAZORIA COUNTY

Stanolind O. & G. Co.'s No. 1 Wooten, 466 ft. S of N line, 466 ft. from SE line of 70-ac. tract, A.C.H.&B. Sur. No. 1.
9⅝-in. csg. 4,362 ft.; T.D. 4,378 ft.; drlg. plug.

Stanolind O. & G. Co.'s No. 1 W. J. Miller, 466 ft. out of SW cor. of the Miller 3,939-ac. tract, in A.C.H.&B. Sur. No. 2, 2,000 ft. E of discovery well.
T.D. 6,009 ft.; 7-in. csg. 5,977 ft.; flowed 169 bbls. in 24 hrs. through ⅛-in. and 1/16-in. choke; tubing pressure 900 lbs.; csg. pressure 900 lbs.

Stanolind O. & G. Co.'s No. 1 Steve Paul, 476 ft. from the E line and 466 ft. from N line of 160-ac. tract, A.C.H.&B. Sur. No 2, 2,100 ft. S of discovery well.
S.D. 5,700 ft.

MANVEL—BRAZORIA COUNTY

Texas Co.'s No. 2 Gulf Coast Home Co., 347 ft. S. 441 ft. W from NE cor. of Lot 38, H.T.&B. Sur. No. 2-B.
Rigging up.

Bowles & Borsodi's No. 2 Norvell Investment Co., C of Lot 57, H.&T.C. Sur.
Drlg. shale 3,310 ft.

Gulf Prod. Co.'s No. 1 T. L. Ellis, 330 ft. each way out of S cor. of 80-ac. lease, H. Little Sur.
Drlg. shale 3,802 ft.

J. W. Sorrells' No. 1 Swift, Blk. 21, Abst. 318, H. N. Little Sur.
Derrick.

Sterling O. & R. Co.'s No. 1 W. A. Gamble, 300 ft. from E line and center N and S of Lot 78, E. Little Sur.
Coring sandy shale 4,020 ft.

E. H. Stone's No. 1 H. McCauley, 350 ft. from E line, 300 ft. from S line of Lot 2, A.C.H.&B. Sur.
7-in. csg. 3,970 ft.; pulling tubing to W.O.

Texas Co.'s No. 9 Houston Oil Field Assn., 263 ft. N of SW line and 330 ft. NW of SE line, Blk. 1, A.C.H.&B. Sur.
Building derrick.

Texas Co.'s No. 6 Ewing, 330 ft. N, 47 deg., 59 ft. W and 263 ft. S, 41 deg., 40 ft. W of SE cor. of lease.
T.D. 4,045 ft.; P.B. to 3,635 ft.; 7-in. csg. 3,635 ft.; I.P. 360 bbls. per day; tubing pressure 440 lbs.; csg. pressure 167 lbs.

Texas Co.'s No. 1 C. P. Dawson, 2,475 ft. S. 441.9 ft. W of NE cor. of Lot 59, H.T.&B. Sur. No. 23.
T.D. 5,645 ft.; 7-in. csg. 5,627 ft.; waiting on orders.

Texas Co.'s No. 3 A.R.G.G.H. Co., in C of Lot 37, H.&T.C. Sur. No. 23.
T.D. 5,985 ft.; P.B. and standing at 3,800 ft.; T.D. 3,954 ft.

Texas Co.'s No. 17 Houston Oil Fields Assn., 244 ft. S, 244 ft. W, from NE cor. of Lot 1, A.C.H.&B. Sur. No. 91.
Location.

Texas Co.'s No. 16 Houston Oil Fields Assn., 247 ft. S. 440 ft. E from NW cor. of Lot 19, A.C.H.&B. Sur., No. 91.
Location.

Texas Co.'s No. 1 J. L. Lemmer, 330 ft. S

(Continued on Page 168)

ing arrangements for a 10,000-foot test to be drilled in this area. If the above test proves to be a failure, the producing limits of the field will be defined to the north, northwest and south.

Dickinson

In the Dickinson Field, Galveston County, Humble Oil & Refining Co. is rigging up for its No. 3-A Stewart, located 338 feet south of the easterly northeast corner, and 2,016 feet west of the easterly east line in the John Sellers Survey, approximately 1,400 feet due east of the company's No. 1-B Maco Stewart, a producer. The company's No. 1 Danielson, topped a sand showing oil and gas at 9,109 feet and is coring ahead below 9,114 feet. Southwest, aproximately 4,000 feet of No. 1-B Maco Stewart, the company's No. 1 Schaper, in the W. K. Wilson Survey, is coring in sand and shale below 8,557 feet. The operators attempted to make a drill stem test from 8,400-8,557 feet.

Manvel

The first commercial producer to be completed in the Miocene sand in the southeastern part of the Manvel Field, Brazoria County, was made at Texas Co.'s No. 1 J. L. Lemmer, in the Thomas Spraggins Survey. Bottomed at 4,122 feet, with 7-inch casing cemented at 4,103 feet, it was completed for an initial production of 14 bbls. per hour through a one-quarter-inch choke, with tubing pressure 400 pounds. The casing pressure was sealed off. It extends the producing limits 80 feet southeast, and is due south of the company's No. 1 C. W. Wray which is producing from the Oligocene sand at 5,686 feet. The test was originally drilled to a total depth of 6,017 feet and missed the Oligocene sand. After an electrical coring test was made of the hole, it was plugged back and sidetracked at 3,750 feet and redrilled to its present depth. In the northern part of the field, E. A. Stone and others' No. 1 McCauley, in the A.C.H.&B. Survey, was having trouble in completing their Miocene test. Sand showing oil was cored from 3,958-69 feet and casing was cemented at 3,957 feet. When it was tested the well failed to flow and the operators were pulling tubing preparing to work it over. It is generally believed that the casing is set too high in the gas sand, and that the screen may be sanded up. It will extend production 800 feet northwest if it makes a commercial well. One mile west in the E. Little Survey the outpost test of Sterling Oil & Refining Co.'s No. 1 Gamble is coring in sandy shale below 4,020 feet. A slight showing of oil was encountered in sand and shale from 3,961-4,001 feet.

Batson

Two more locations were made in the Batson Field, Hardin County, bringing the total number of active tests to five. This increase in development is due to the discovery of two deeper horizons, uncovered by John Derring and others' No. 1 Hooks and No. 1 Cruse, respectively. Sterling Oil & Refining Co. made a deal with the Jordan Drilling Co. for a five-acre tract, located west of the Cruse well which was completed a few days ago for a large producer, and is rigging up for its No. 1 Doucette, located 565 feet north and east from the northeast corner of the H. A. Amann tract in the W. Donaho Survey. The fourth test to be started by John Derring was made for his No. 2 Cruse, located 200 feet east and 50 feet south of No. 1 Cruse in the W. Donaho Survey.

Sour Lake

On the south flank of the Sour Lake Field, Hardin County, Sun Oil Co. has abandoned its No. 2 Bernard, a deep test which showed possibilities of production last week, when it showed considerable gas pressure for three hours before going dead. It was originally drilled to 7,914 feet, but was plugged back, sidetracked and redrilled to its present depth of 7,429 feet. Northwest, Alpha Petroleum Co.'s No. 3 Weiss, which made 50 bbls. per hour for two hours, and then sanded up, is flowing an estimated 10 bbls. of oil per day by heads, and unless it shows considerable improvement, it will probably be abandoned. Total depth is 6,774 feet.

Jefferson County

Another deep wildcat test, located in northwestern 'Jefferson County, was abandoned. It was Sun Oil Co.'s No. 1 Hugh Long, located on the Nome Prospect, which was abandoned at 8,484 feet, after it began to show salt water when it had been swabbed to 6,700 feet. It was originally drilled to 9,045 feet, but due to a fishing job, it was plugged back, sidetracked and redrilled to its present depth. It is expected that the company will move the rig to its No. 1 Herbert and Broussard, a location in the Blackman Survey, several miles southeast.

Thirteen miles west of Belville, in Austin County, Arkansas Fuel Oil Co. has made location for a wildcat test to be drilled on the Herman W. Peschel lease, in the R. Stolze Survey, Abstract 290.

Iowa

In the same parish, but in the Iowa Field, Shell Petroleum Corp.'s No. 6 Stafford, Section 18-9s-6w, was completed for an initial production of 1,336 bbls. per day through a twenty-three-sixty-fourths inch choke with 1,400 pounds on the tubing and 1,000 pounds on the casing. The company's No. 14 Heyd, Section 13, is due to be completed during the week. It cored sand with shale streaks from 6,625-6,703 feet of which 50 feet was estimated to be sand, and the operators were preparing to set screen. Seven-inch casing will be cemented at 6,623 feet.

Roanoke

A one-quarter mile north extension was registered for the Roanoke Field, Jefferson Davis Parish, when Shell Petroleum Corp. completed its No. 1 Amelia Carter. The well was still cleaning itself through a one-quarter inch choke, and was estimated good for 720 bbls. per day. Tubing pressure registered 1,075 pounds and casing pressure 975 pounds. Thirty-five feet of screen was set in sand topped at 8,684 feet and bottomed at 8,697 feet.

This is the third producer to be completed by the company and makes the sixth producer for the field. It is located 660 feet north, and 330 feet west of the SE cor. W half Section 1-9s-6w, and is producing from the same horizon from which the company completed its No. 1 Kratzer, the discovery well.

Three-quarters of a mile southwest of the discovery, Humble Oil & Refining Co.'s No. 3 Devilbiss in Section 14-9s-4w, has been plugged back again to 8,903 feet and is preparing to perforate the casing. It tested salt water during the week after the casing had been perforated from 9,198-9,203 feet. The company has rigged up its No. 2-B Devilbiss, a new location approximately 1,127 feet west of No. 1-B Devilbiss, a producer in Section 11-9s-4w.

Gillis Field

In the Gillis Field, Calcasieu Parish, two wells being drilled by Union Sulphur Co. have missed the deep pay found in Fohs Oil Co.'s No. 1 Castle, and unless they pick up another deep sand, they will be marked up as dry holes. The company's No. 1 Buhler in Section 11-9s-8w, is coring in brittle shale below 7,251 feet. In Section 13, its No. 1 O. H. Castle is coring in sand and shale below 7,225 feet. Fohs Oil Co.'s No. 1 Fohs, which opened up the second deep pay for the field several days ago, is producing from a total depth of 7,065 feet.

Three wells being drilled by Fohs Oil Co., in the area of the company's No. 1 Castle, have reached interesting depths, and are due to pick up the deep pay during the first part of the week. No. 2 Castle in Section 14 is drilling in hard lime below 6,794 feet. In Section 13, its No. 3 Castle is drilling in sandy shale below 6,980 feet and is due to start coring for the sand. In the same section No. 4 Castle is drilling in sandy shale below 6,897 feet.

Bosco

In the Bosco Field, Acadia and St. Landry Parishes, two tests have cored saturated sand and are now preparing to cement casing. Superior Oil Producing Co.'s No. 2 Johnson, Section 34, cored from 8,643-53 feet and recovered 9 feet of saturated sand. It will be cored a few feet deeper and will then set casing. In the same section the company's No. 5 Comeaux, within the proven limits of the field, topped the sand at 8,684 feet and cored to 8,711 feet, the total depth. Seven-inch casing will probably be set at the top of the sand.

A most unusual drilling record was established at Superior Oil Producing Co.'s No. 6 Hernandez, in Section 34.

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Wyandot, Hardin and Seneca Counties Busiest in Lima Field, Northwest Ohio

By GEORGE A. WHITNEY
Staff Correspondent Central West Fields

FINDLAY, Ohio, Mar. 25.—The most active area in the Lima Field is in Wyandot, Hardin, and Seneca Counties. In Marion County, the Claridon Oil Co.'s test on the H. C. Barnhardt farm, Section 11, Claridon Township, found the St. Petersburg sand dry from 2,730-55 feet. The hole was filled up to the Sylvania sand which is 762-85 feet where showings of both oil and gas were found, and it will be given a shot in hopes of making a commercial well.

In Seneca County, Industrial Gas Co. is drilling No. 2 Charles Feasel farm, Section 32, Liberty Township. In Hardin County, Kenton Oil & Gas Co. has a rig for No. 3 William McMahon farm, Section 17, Pleasant Township, and Bert Sheldon has a rig up for No. 2 on the Ora Bush farm, Section 31, Blanchard Township.

In Wyandot County, Murphy & Co. is drilling No. 2 Hakes & Fox farm, Section 5, Tymochtte Township. Wood and others are shut down at 1,100 feet in No. 3 Edward Orton farm, Section 22, Pitt Township. Newcomer & Co. are drilling No. 1 Hiram Statler farm, Section 22, same township, around 500 feet. Bosse Brothers are drilling around 250 feet in No. 1 on the Isaac Stansberry farm, Section 28, Salem Township.

In Hardin County, Simms Oil & Gas Co. is drilling No. 2 on the Aetna Life Insurance Co., in Buck Township.

In Wood County, H. Hille is drilling No. 1 H. Linkey farm, in Troy Township, around 300 feet.

In Sandusky County, Montgomery & Co. is shut down at 2,580 feet in No. 2 N. F. Hetrick farm, Section 17, Rice Township.

CENTRAL OHIO

Ten completions were reported from the Central Ohio Field, two being oil wells with an initial of 24 bbls., three gas wells and five dry holes. In Ashland County, Stewart and others' test on the Clyde Eberhardt farm, Section 10, Lake Township, is a light gas well in the Berea sand at 587 feet, and may be drilled deeper.

In Medina County, Glen Yannayon is drilling No. 3 on his own farm, Lot 31, Liverpool Township. Miller & Latshaw is drilling No. 1 Phillip G. Orth farm, Lot 62, Medina Township. Ohio Fuel Gas Co. is drilling No. 1 on the Semko Ostaff farm, Lot 41, same township, No. 1 Clyde L. Rose farm, Lot 25, Guilford Township, and No. 1 J. C. Treman farm, Lot 50, Granger Township. Same company has made a location for No. 1 Glen A. McFarren farm, Lot 7, Homer Township. East Ohio Gas Co. is drilling No. 1 E. S. Culp farm, Lot 11, Chatham Township. In Montville Township, J. A. Price is drilling No. 7, Anton Kungli farm, Lot 48.

In Holmes County, Holly T. Schneeberger is drilling No. 1 fee, Section 13, Mechanic Township.

In Lorain County, J. W. Cushing is drilling No. 1 on the Hanshaw Chemical Lands, Lot 6, Elyria Township. R. E. Gain is shut down at 1,000 feet in No. 1 Isabel Gain farm, Lot 86, Russie Township. In Avon Township, J. W. Cushing is shut down at 2,278 feet in No. 1 on the James and Anna Lewis farm, Lot 15.

In Wayne County, John Harpster is shut down at 425 feet in No. 1 E. & F. Beichler farm, Section 6, Chippewa Township.

In Summitt County, East Ohio Gas Co.'s No. 1 William Ritter farm, Section 18, is a dry hole at 4,178 feet. Same company is shut down at 275 feet in Rose Lamb farm, Section 17, same township.

In Fairfield County, City Natural Gas Works has a location on the Daniel Steiger farm, Section 1, Greenfield Township.

In Knox County, Upham Gas Co.'s No. 2 E. H. Mickley farm, Lot 40, Union Township, is dry at 2,865 feet. H. E. Perkins is drilling No. 1 R. L. Jones farm, Section 32, Howard Township. Upham Gas Co. abandoned No. 1 on the Milan E. Mezer farm, Lots 11 and 12, Butler Township.

In Coshocton County, Preston Oil Co. is drilling No. 1-1572 on the William Frazee farm, Third Quarter, Newcastle Township, and No. 1-1574, on the same farm, and has a location for No. 4-1575 on the Robert Giffin farm, same three-quarter section. E. J. Edmonds is drilling No. 1 on the Charles McCoy farm, Lot 39, Virginia Township, same county.

In Licking County, Wehrle Gas Co. has a rig for No. 2 Charles Flory farm, in Newark Township.

In Muskingum County, Pure Oil Co.'s No. 3 on the Zonetta Brown farm, NW, Section 6, Jackson Township, produced an initial of 16 barrels at a total depth of 3,119 feet. Whitehill and others are drilling No. 5 John Bayer farm, Hopewell Township. H. P. Muhlback has a location for No. 1 on the William O. Burrier farm, Section 5, Licking Township.

In Athens County, Bowman Bros.' No. 1 Lyle E. Harris farm, in Berne Township, was dry at 826 feet. Ohio Fuel Gas Co. has a location for No. 1 Albert M. Funk farm, Fractional Section 4, same township. In Carthage Township, C. W. Nuzum is drilling No. 3 C. W. Nuzum farm, Section 24.

Stark County

In Stark County, Ohio Fuel Gas Co. is drilling No. 3 A. J. Stoner farm, Section 3, Jackson Township, and East Ohio Gas Co. has a location for No. 2 on the George Letherman farm, Section 11, same township. In Lawrence Township, Wittmer Co. is drilling No. 1 Anna Wagner and others farm, Section 5, same county. East Ohio Gas Co. shut down at 300 feet in No. 4 Howard Fawcett farm, Section 17, Jackson Township.

In Guernsey County, Frank Lyons and others' test on the G. W. Rich & Co. farm, is an 8-bbl. producer. George Jewell and others are drilling No. 1 on the J. W. and Isaac L. Warehime farm, Lot 9, Richland Township. L. Sebo & Co. is drilling No. 1 J. H. Hayman farm, Lot 9, same township. In Oxford Township, George Jewell and others have a location for No. 1 on the Albert F. and Etta Henderson farm, Lot 29. In Washington Township, George L. Kermodle is drilling No. 6 R. C. Colley farm. Preston Oil Co. has a rig for No. 1 on the

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Encouraging Wildcat Completions in Michigan; Two Important Wildcat Tests Are Failures

By PAUL A. ELLIOTT
Staff Correspondent, Michigan Fields

MUSKEGON, Mich., Mar. 25.—Shows of oil and gas encountered in two central Michigan wildcats and the failure of two other important wildcats held attention of Michigan operators during the week. The two wildcats indicated possibilities of new producing areas in Crystal Township, Montcalm County, and Warren Township, Midland County, while the disappointments were recorded by dry holes in Beaverton Township, Gladwin County, and Howell Township, Livingston County.

J. W. Leonard, Jr., and others cased at 3,150 feet above the Dundee limestone formation in No. 1 Otto and Goldie Durbin test, NW NW NE Section 11-10n-5w, which proved the most encouraging wildcat in several months when it filled 500 feet with oil after drilling only 8 feet into the Dundee. It was shut down to test before drilling deeper. It is several miles south of unsuccessful deep tests in Ferris Township, same county, last year by the Daily Crude Oil and Atha Oil companies. It discovered the first show below the upper Traverse in any Montcalm County test. Present production from the Home Township, Montcalm County, Field, is all from the upper Traverse.

Drilling was continued for only 1 foot into the pay as operators recalled all other Dundee tests in the county have drilled into bottom water quickly after striking light shows in the top of the formation. Nearest test to the Leonard-Durbin was Atha Oil Co.'s hole abandoned as a duster in Ferris Township after drilling through the Dundee and into the Monroe formation.

Show in Traverse

Nearly as great interest was exhibited in a show of gas and oil encountered in the upper Traverse in Howard L. Foster and J. V. Wicklund's No. 1 Carrie Neal, SE NE SE Section 13-16n-2w, Warren Township, Midland County, about 8 miles south of M. F. Whitehill's No. 1 Omer Kintner test in Section 11, Beaverton Township, Gladwin County, brought in last fall as the discovery well in the Beaverton area. The formation was topped at 3,106 feet and the show encountered at 3,468 feet with the bottom struck at 3,510 feet. Drilling was to be continued to the Dundee with completion in this formation anticipated within 10 days.

The Neal show was magnified in importance by the failure of the Theodore Roosevelt Oil Co.'s No. 1 Arnold Haviland, SE NE SE Section 4-17n-2w, Beaverton Township, Gladwin County, which drilled into bottom water in the Dundee and was to be plugged and abandoned at a total depth of 4,209 feet. Drilling of the Haviland test had been followed closely as it was the nearest of the several other company tests in the vicinity of the Kintner well brought in October 20, 1934, with an initial flow of 70 bbls. a day. The Haviland was about 1½ miles northwest of the Kintner. The Dundee was topped in the Haviland at 3,916 feet and casing was run at 3,920 feet. Major attention in the territory now has been turned to the Neal test although several others also were active in Beaverton and adjoining townships and counties.

Sun Oil Co.'s No. 1 Mary A. Hines, C NW NE Section 31-17n-1w, Tobacco Township, Gladwin County, was reported drilling at more than 1,100 feet, while Beaverton Oil & Gas Co.'s No. 1 Mrs. Ross, SE SW NE Section 7, same township, was starting over again after losing its first hole at 150 feet and skidding the rig. The Sun company also is starting No. 1 Becker, C SE SE Section 2-18n-1w, Arthur Township, Clare County, latest wildcat announced in the Beaverton area. M. F. Whitehill was driving pipe at several hundred feet in his second test, No. 1 Spicer, N SW NW Section 11-17n-2w, Beaverton Township.

Deep Test Dry

Talbot Oil Co.'s deep test, No. 1 McPherson estate, NE NE NW Section 35-3n-4e, in Howell Township, Livingston County, was dry 10 feet in the St. Peters sandstone when water was encountered at 5,910 feet. It was drilled to a total of 5,953 feet at which it probably will be plugged and abandoned unless plugged back to a show of about 200,000 feet of gas for a test in the Salina.

Although not as deep as two or three other central Michigan tests, the McPherson hole is one of the deepest drilled in the state and tested more formations than any of the deeper tests. It was drilled through the Berea, upper and lower Traverse, Dundee, Monroe, Sylvania, Salina, Trenton and into the St. Peters. It was started last October and struck two shows of gas, one in the Salina at about 4,000 feet and another in the Trenton at 5,069 feet. When the Trenton was reached 4,900 feet of extra heavy 6-inch casing was run. Fishing jobs in the lower Monroe at 1,750 and at 4,750 delayed progress.

Plans to test the Lake Superior horizon still deeper than the St. Peters were abandoned. Geological information obtained from the test will be of great value, though the well never makes commercial production. Water was encountered at about 10 feet in the St. Peters sandstone. The Trenton was found to be more than 1,000 feet thick and did not carry water.

Hundreds of acres are still under lease on the Howell structure where oil and gas showings were first reported many years ago in shallow water wells. A number of companies contributed to drilling the McPherson more than a mile deep in this latest attempt to uncover oil or gas in commercial quantities near Howell.

Successful Completions

One of the important completions of the week was W. Hunter Atha's No. 1 Edward Little, NW SW SE Section 31-16n-4w, Vernon Township, Isabella County, shut down since October 15 at 1,470 feet, or just above the Michigan Stray sands. It was drilled into the Michigan gas sands making 3,000,000 feet a day open flow after topping the formation at 1,503 feet and drilling only 1 foot in. It is about 4 miles west of gas production in Vernon Township and is expected to result in an important extension and increase is gas reserves of this section.

Mammoth Petroleum Corp.'s No. 2 Verette, located in Section 23 of Vernon, was increased from an initial of 50 to 1,300 bbls. the first day by acid treatment. It dropped 400 bbls. the second day and to 10 bbls. an hour the third.

Fred Turner and others completed in Porter Township, Midland County, No. 3 C. L. Baxter, SE NE NE Section 22-13n-1w, which made about 400 bbls. a day after treatment. Dundee limestone was topped at 3,365 feet and the well drilled to 3,403 feet.

Another well drilled on the lease last summer was plugged and abandoned when it went into water so the operators had decided not to drill No. 3 until forced by the successful offset of Rex Oil & Gas Co. on the adjoining Howland lease in Section 23.

Nearing Completion

Columbia Oil & Gas Co.'s No. 1 E. and A. Van Conant, SW SW SE Section 25-16n-4w, Vernon Township, Isabella County, was drilling at more than 1,100 feet and expected to complete in the Michigan Stray gas sands this week. Elmer E. Brehm and Bond Syndicate's No. 1 William West estate, SE NE NE Section 25-15n-4w, Isabella Township and county, was drilling at more than 3,580 feet and ready to test the Dundee soon. Pure Oil Co.'s No. 1 Lucy Baker, SW NW SE Section 15-13n-5w, Fremont Township, Isabella County, was ready to test the upper Traverse after being plugged back from 4,253 feet, where it was unsuccessful through the Dundee and Monroe, to a show in the upper formation at 3,083 feet.

Chippewa Oil & Gas Co. was expected to drill into the Michigan Stray gas sands in two Broomfield Township, Isabella County, tests which have been delayed by floods and bad roads. They were No. 1 Carl Rhode, C SW NE Section 15-14n-6w, which topped the sand at 1,338 feet and was drilling in and No. 1 Mrs. Diehl, C NE SE, also Section 15, which was rerunning casing at 1,200 feet. J. W. Leonard, Jr., and others' No. 2 Stanley Demski, SW SE SE Section 28-15n-3w, Denver Township, Isabella County, was drilling at 3,370 feet and nearing early completion in the Dundee.

Two Mecosta County tests were nearing the Michigan gas sands: Jasmid Oil Corp.'s No. 1 Coopersville State Bank, C S half Section 22-13n-10w, Aetna Township, a wildcat extension near the Austin Township Field, and Columbia Oil & Gas Co.'s No. 1 Freeman, SW SW SW Section 24-13n-8w, near other Hinton Township, Mecosta County, gas production. The former was drilling at 850 feet and the latter at about 950 feet. Gordon Oil Co.'s No. 1 Tiffany, C SW NE Section 32-13n-7w, Millbrook Township, same county, was drilling at more than 800 feet.

Midland County

A Midland County wildcat, Howard F. Patterson's No. 1 David Haskins, NW NW SW Section 25-13n-2e, Ingersoll Township, was shut down in the Monroe after being dry in the Dundee. McClanahan Oil Co.'s No. 3 Eliza Breu, NE NW SE Section 20-13-1w, was nearest to completion in the Dundee of about 20 active tests in Porter Township, Midland County Field. Several other Greendale, Jasper, Lee, Mills and Mount Haley Township tests were drilling but not near completion.

Two Wildcats Dry

Two other wildely separated wildcats, one in Oregon Township, Lapeer County, in southeastern Michigan, and the other in Arcadia Township, Manistee Township, in northwestern Michigan, also were dry. The former was C. M. Holley's No. 1 Thom, SW NE NE Section 9-8n-9e, dry in the Berea at 1,421 feet with a possibility of being deepened. T. K. Buzard, trustee's No. 1 Fischer Robbins, NE SW Section 24n-16w, Arcadia Township, about 100 miles north of Muskegon was dry in the Dundee topped at 1,252 feet and drilled to a total of 1,383 feet. Reed Oil Co.'s No. 1 J. J. McDermott, SW NE SW Section 10-10n-16w, Muskegon Township, on the Muskegon River flats, was to be abandoned as a failure in the Traverse and Dundee.

New Locations

Two prospective new tests were reported being considered in Oceana County, one by the Reed and McClanahan Oil companies in Otto Township, and the other by Detroit interests in the Knox Swamp in Section 5, of Ferry Township. West Michigan Consumers Co. is deepening two more wells to the Monroe gas in Muskegon Township.

Six new permits were issued. Two new Porter Township, Midland County, tests are Pure Oil Co.'s No. 4-A, W. W. Hoyt, SW SE SE Section 17-13n-1w, and St. Louis Pipe & Supply Co.'s No. 1 Hoyt Brothers, SE NE NW Section 19. Gordon Oil Co. will drill No. 1 Lally Brothers, NE NW SW Section 19-22n-2e, West Branch Township, Ogemaw County, while Hubbell Oil Producing Co. has taken a permit for No. 1 Mary Jacobs, NW NE SE Section 9-14n-2w, Greendale Township, Midland County, both in proved areas. Taggart Brothers, Inc., of Big Rapids, have started No. 11 to the Michigan Stray gas sands on a State of Michigan lease, C NE SW Section 11-14n-9w, Austin Township, Mecosta County, also in a proved gas area. W. Hunter Atha took out a permit for No. 1 Melissa Larrance, C NE SE Section 36-16n-5w, another gas test in Gilmore Township, Isabella County, where one small producer has been completed.

Production

Average daily production again hit a high point in Michigan during the week ended March 16 when it averaged 36,867 bbls., or 5,267 bbls. more than the March allowable and 4,940 bbls. more than the week before.

Although the greatest portion of the increase came in the combined Porter-Yost area which jumped from 25,259 to 28,719 bbls. a day, Ogemaw County production made a greater percentage of increase rising from 398 bbls. a day during the week ended March 9 to 809 bbls. a day during the following week. New wells recently completed in West Branch, Mills and Churchill Townships have taxed pipe line capacities. In addition to this, Bay Refinery at Bay City, which had been running Ogemaw crude, was shut down necessitating tank car shipments by Simrall Pipe Line Co. to other plants.

Other fields increased as follows: Greendale-Chippewa, 3,264 to 3,652 bbls. a day; Vernon-Leaton, 2,315 to 2,799 bbls. a day; Montcalm from 243 to 298 bbls. a day; Saginaw-Lapeer from 105 to 119 bbls. a day and Muskegon from 205 to 255 bbls. a day. Beaverton production remained the same at 10 bbls. a day while the Oceana Field was the only territory to show a decline, dropping from 128 to 107 bbls. a day. The total increase for the week was from 31,927 to 36,867 bbls. a day.

Michigan operators welcomed an increase of 1,100 bbls. a day in the federal allowable for April from 31,600 to 32,700 bbls., although they considered it still insufficient to meet present demands for Michigan crude.

ALEX ROSE DIES

PETROLIA, Ontario, Mar. 23.—Alex Rose died here recently, aged 52. As a young man he learned the drilling trade at Petrolia, and later drilled on Manitoulin Island and near Portland, Maine.

Kansas Production Exceeds All Former Records With New Daily Average of 153,050 Barrels

By JAMES McINTYRE

Production in the Sunflower State again showed its ability to exceed former records as it ended the week with a daily average production of 153,050 bbls., exceeding the previous week's figure by 3,309 bbls. daily. New production came from 13 oil wells with a combined initial of more than 17,000 bbls. and one gas well was good for 11,000,000 feet of dry gas. The record for the week showed 22 wells completed of which five were dry, two being wildcat tests. Forty-one new operations were started the past week, the bulk of new work being in Russell and Reno Counties.

Estimated Production

Estimated daily average production of Kansas for the week ended March 23 and for the preceding week follows:

	Barrels	
	Mar. 23	Mar. 16
Haury-Burrton	22,700	25,125
Ritz-Canton	9,325	8,650
Hollow	5,425	5,325
Voshell	6,425	7,100
Johnson	2,318	2,210
Nikkel	5,000	4,950
Sedgwick County	10,400	9,325
Ellsworth County	4,682	4,210
Barton County	2,102	1,540
Rice County	21,990	21,646
Ellis County	487	450
Kingman County	1,034	1,065
Stafford County	2,870	1,830
Russell County	12,425	12,600
Greenwood County	11,000	10,500
Butler County	19,000	18,900
Other pools	15,867	14,315
Total Kansas	153,050	149,741

New Rice County Pool

About 7 miles southwest of Lyons in central Rice County, the Gypsy Oil Co. opened a new pool in its No. 1 Keesling wildcat which makes a total of 15 oil pools for this prolific county. Production is coming from the Siliceous lime encountered from 3,239 feet to 3,261 feet, total depth, and as it stands looks good for about 100 bbls. daily. However, further penetration of the lime or acid treatment should increase production materially. A more and exact description of this well is 4½ miles southeast of Chase, 2½ miles east of the Sharpe Pool.

Ellsworth County

What some operators might consider an extension to the Lorraine Pool in Ellsworth County, is the discovery of oil in the test nearing completion of Carter Oil Co. and associates' No. 1 Tuebner, a wildcat in the SE NW Section 26-17s-9w, which has a hole full of oil and slopping over from the Siliceous lime barely scratched from 3,177½-78 feet, total depth. The well was shut down to run 7-inch casing before conducting a production test. This well is on a communitized block comprising nearly 9,000 acres and is 1½ miles south of production in the Lorraine Field.

In the Lorraine Pool, Twin Drilling Co. and others' No. 2 Rolfs, NW NW SW Section 13-17-9w, was completed on the pump for 1,300 bbls. of oil in the Siliceous lime at 3,199-3,203 feet, total depth.

Bradley & Scanlon and others' No. 1 Mohney, NE SE SE Section 14-17-9w, was completed for a potential of 1,462 bbls. of oil in Siliceous lime from 3,194-99½ feet, total depth. Another completion for the Lorraine Pool of Ellsworth County.

Farther west in Ellsworth County in the Stratman Pool, Smith & Ash and Texas Co.'s No. 2 Stratman, SW NE NE Section 12-17-10w, encountered a hole full of water in the Siliceous lime and was dry and abandoned at 3,375 feet, total depth.

In the Stoltenberg Pool of Ellsworth County, Stanolind Oil & Gas Co. and Gypsy Oil Co.'s No. 3 Frevert, SE NE NE Section 21-16-10w, had Siliceous lime from 3,330-37 feet, total depth, which was good for 797 bbls. of oil and making considerable water on its completed gauge.

About midway between the Stratman and Lorraine Pools of Ellsworth County, Western Exploration Co. had location staked for its No. 1 Wilkins in the NW SW NW Section 9-17-9w, a wildcat. Davis, Winkler and Koch had location made for No. 1 Melchert, NW NE NE Section 23-17-9w, in the Lorraine Pool of Ellsworth County.

Scott County

About 3 miles southwest of Atlantic Oil Producing Co.'s No. 1 Vaniman, Mississippi lime discovery in Scott County, far western Kansas, same company has staked location for No. 1 Mark-"A," in the C SE SE Section 28-20-33w. The Vaniman well was completed in the early part of this year in the Mississippi lime logged at 4,670-4,722 feet, total depth, gauging 572 bbls. of 23.5 gravity crude which tested under analysis: 2 per cent b.s.; 10 per cent gasoline, 8.6 per cent kerosene and the balance asphalt.

Russell County

E. K. Carey and others' No. 1 Reed, NW NW SW Section 34-13-14w, south end of the Russell Pool of Russell County, had Siliceous lime from 3,306-11 feet, total depth, which filled the hole 1,800 feet with oil in eight hours, swabbing 10 bbls. per hour. It was acidized with 1,000 gallons and was completed for 203 bbls., the acid failing to increase production.

In the Forham Pool of Russell County, Central Petroleum Co.'s No. 1 Dortland-"B," SW SE NW Section 4-14-15w, topped Oswald lime at 3,029 feet, drilling same to a total depth of 3,065 feet which yielded 621 bbls. of oil for its completed gauge after acidization. It swabbed 12 bbls. per hour before acid was applied.

Phillips Petroleum Co.'s No. 2 Holland, NW SW SW Section 13-14-15w, Neidenthal Pool of Russell County, was completed for 573 bbls. of oil in Siliceous lime 3,228-34 feet, total depth.

In the same pool, Lario Oil & Gas Co. and Texas Co.'s No. 1 Boxberger, NW cor. Section 24-14-15w, Russell County, had Siliceous lime from 3,252-53 feet, total depth, which made 840 bbls. of oil and a small amount of water on its completed gauge.

Russell County continues to be one of the favored spots in western Kansas for new development and last week drew 10 new operations as follows: Ryan Petroleum Co.'s No. 1 Newbold, a wildcat located in the NW SE NE Section 25-12-15w, spudding; Hartman & Blair's No. 1 Cook, NE cor. Section 26-13-15w, cellar; Texas Co.'s No. 1 Boxberger, NE SE Section 33-13-14w, location; Hartman & Blair's No. 1 Rouback, SE NW Section 2-14-15w, location; Phillips Petroleum Co.'s No. 3 Holland, NE SW SW Section 13-14-15w, location; Gypsy Oil Co.'s No. 2 Neidenthal, SE NE SE Section 14-14-15w, moving in; Hutchinson Oil Co.'s No. 1 Clarke, NW cor. Section 3-14-14w, moving in; R. C. Tarrant's No. 1 Williamson, SE NW Section 9-14-14w, building rig; Hartman & Blair's No. 1 Boxberger, NE cor. Section 26-14-14w, location, and Sinclair Prairie Oil & Gas Co.'s No. 3 Hefferman, NW SW NE Section 26-15-13w, moving in material.

Barton County

Lying between the Sellens Pool of Russell County and the Beaver Pool of Barton County, Pryor and Lockhart had ponds dug for their No. 1 Herrington, a wildcat location in the NE NW Section 6-16-12w, Barton County.

Rice County

Rice County development for the week resulted in three wells being completed and seven new operations. In the Grove Pool, Lebow and others' No. 1 Doll, SE SW Section 20-19-9w, was deepened from old total depth of 3,245 feet to 3,257 feet and completed for 564 bbls. oil first 24 hours. Empire Oil & Refining Co.'s No. 2 Grove, NE SW NE Section 29-19-9w, Grove Pool, found Siliceous lime at 3,200-15 feet, total depth, good for 1,724 bbls. of oil after acid treatment. It was completed.

About 3 miles west of Lyons in Rice County, the wildcat test of E. H. Langston and others, No. 1 Markle, NE SW Section 1-20-9w, which logged Viola lime at 3,309 feet and Siliceous lime at 3,415 feet, encountered a hole full of water at total depth of 3,420 feet and was abandoned.

New developments in Rice County follow: Phillips Petroleum Co. and Indian Territory Illuminating Oil Co.'s No. 1 Krampe, C W half NW SE Section 31-19-10w, location; Ira L. Keith and others' No. 1 Volkland, SE NE SE Section 20-19-9w, total depth 3,225 feet, rigging up to deepen; Sinclair Prairie Oil Co.'s No. 1 Volkland, NE SE SE Section 20-19-9w, total depth 3,225 feet, deepening at 3,231 feet; Smith, Ash and Phillips Petroleum Co.'s No. 3 Beyers, SW SE NW Section 21-19-9w, location; Empire Oil & Refining Co.'s No. 2 Tournear, SW SE NE Section 29-19-9w, location; same company's No. 7 Proffitt, SW SE Section 6-20-9w, building rig; Roy Ramsey's No. 3 Hilton, SE SW Section 6-20-9w, building rig.

McPherson County

In the Ritz Pool of McPherson County, Lario Oil & Gas Co. and Shell Petroleum Corp.'s No. 4 Hill, NW NE SE Section 23-19-2w, which was deepened from the Viola lime, found Wilcox sand 3,420-42 feet, total depth, good for only 15 bbls. of oil, its completed gauge. In the same pool, Lario Oil & Gas Co. and Shell Petroleum Corp. were rigging up to deepen their No. 2 Gratton, NW NE SW Section 24-19-2w; Dickey Oil Co. had rig up for its No. 3 Tull in the NE SE SW Section 13-19-3w, Chindberg Pool of McPherson County.

Reno County

The Burrton-Haury sector of Reno County had eight completed oil wells, one rig abandoned, one dry hole and eight new operations for its contribution to the week's work. In the north end of the pool, Manning & Terry and others' No. 1 Bartel, SE SW Section 36-22-4w, encountered a hole full of water in the Hunton lime from 3,626-46 feet, total depth, and it was abandoned.

Barnsdall Oil Co.'s No. 8 Sabin-"B," SE NE SE Section 11-23-4w, Haury sector of Reno County, was finished with an initial production gauge of 1,878 bbls. of oil coming from Hunton lime logged at 3,607-10 feet, total depth, which had been acidized. The same company's No. 9 Sabin-"C," SE NW SE Section 11-23-4w, getting Hunton lime from 3,573-94 feet, total depth, was acidized with 1,000 gallons which increased production from 865 bbls. to 1,355 bbls. of oil for its completed gauge. Barnsdall Oil Co.'s No. 13 Sabin-"C," NW SE SE Section 11-23-4w, was a rig abandoned.

Wilcox Oil & Gas Co.'s No. 2 Neufeldt, NW SW NW Section 12-23-4w, Burrton-Haury Pool of Reno County, was completed in Hunton lime at 3,617-21 feet, total depth, which yielded 1,433 bbls. of oil upon acid treatment.

Olson Drilling Co. and Shell Petroleum Corp.'s No. 7 Downie, NW NE NE Section 14-23-4w, which flowed 252 bbls. of oil in three hours in Hunton lime at 3,594-3,610 feet, total depth, was acidized and completed for 1,457 bbls. of oil and a small amount of water.

Olson Drilling Co. and Shell Petroleum Corp.'s No. 8 Downie, NE cor. Section 14-23-4w, Burrton-Haury Pool in Reno County, was an extremely small well for this major pool. Hunton lime logged at 3,605-20 feet, total depth, was good for only 79 bbls. of oil and 1,400 bbls. of water.

In the Burrton sector, Olson Drilling Co., Shell Petroleum Corp. and Continental Oil Co.'s No. 6 Blake, NW NE SW Section 23-23-4w, Reno County, found Hunton lime 3,589-3,615 feet, total depth, and a 2,000-gallon acil shot brought forth 3,371 bbls. of oil in 24 hours. It was a completion for the week. Another of Olson Drilling Co. and Shell Petroleum Corp.'s wells, No. 3 Duckworth, NW NE Section 23-23-4w, Burrton-Haury Pool, was completed in the

(Continued on Page 160)

Wildcat Operations in Kansas

Week Ending March 23

(Descriptions are East unless marked otherwise)

BARBER COUNTY

Sam Jarvis et al's No. 1 Morrisse, C SE NE Sec. 23-30-10w.
Rig.

Southern Drlg. Co. et al's No. 1 Davis, 330 ft. from W and 330 ft. from S lines of NE Sec 13-34-15w.
S.D. 2,865 ft.

BARTON COUNTY

D. I. Hall et al's No. 1 Arnold, SE SE SW Sec. 19-18-15w.
Moving in tools.

McMorrow & Spencer's No. 1 Hagen, NE cor. Sec. 33-20-11w.
U.R. 10-in. csg. 2,125 ft.

C. L. Price et al's No. 1 Ehrlich, NW SE Sec. 10-16-13w.
T.D. 260 ft.; fishing

Pryor & Lockhart's No. 1 Herrington, NE NW Sec. 6-16-12w.
Ponds dug.

Suppes & Witt's No. 1 Hayes, SW cor. Sec. 7-16-15w.
Moving in.

BUTLER COUNTY

Trees & Harwood's No. 1 Henley, SW SE NE Sec. 7-24-8.
Drlg. 760 ft.

CLAY COUNTY

Seidel Bros.' No. 1 Younken, C S½ SE NW Sec. 21-9-4.
T.D. 1,775 ft.; S.D.

COWLEY COUNTY

Tom Palmer's No. 1 Wentworth, NW NW NE Sec. 9-35-2.
Shot with 15 qts. at 3,412-17 ft.; pumped 60 bbls. oil, 2 bbls. wtr.; T.D. 3,475 ft.; fishing.

Lloyd, Frost & Study's No. 1 Weathered, SW SE SE Sec. 28-31-3.
Spudded.

A. McCoy's No. 1 Brandenburg, SW SE SE Sec. 17-34-5.
Drlg. 1,255 ft.

Wakefield et al's No. 1 Newton, SE cor. Sec. 21-30-2.
Rig.

ELLSWORTH COUNTY

Carter Oil Co. et al's No. 1 Teuber, 440 ft.

(Continued on Page 170)

Lower Eastern Fields Complete Fourteen Wells; Most Producers Were in Southeastern Ohio

By STAFF CORRESPONDENT

PITTSBURGH, Pa., Mar. 25.—There were 14 completions in the lower Eastern Fields during the week of which 7 were gas wells and 7 producers with an initial production of 190 bbls. There were also 5 dry holes. The majority of the producers was in Southeast Ohio.

SOUTHEAST OHIO

In the southeast quarter of Section 32, Richland Township, Belmont County, Robert W. Lewis and others drilled a test on the Theresa Hryvinak farm through the Berea sand to a depth of 1,850 feet. It proved to be dry.

In Guernsey County, there were two completions. In Section 1, Wills Township, Preston Oil Co. and others completed a test on the David C. Stoneburner farm in the Berea sand at a depth of 1,354 feet, showing for 10 bbls. a day. In Richland Township, Lots 17 and 12, Frank Lyons and others completed a test on the Gilbert W. Rich farm in the same formation with 150,000 feet a day along with 10 bbls. of oil. It is on the farm 455 feet south of the north line and 1,018 feet east of the west line.

In the shallow sands of Medina County, there were several completions. In Chatham Township, Tract 14, Lot 6, Oko oil & Gas Co. completed No. 35 on the T. W. Brinker farm in the Berea Grit at 340 feet. It produced 10 bbls. the first day after shot. In tract 15, Lot 12, same township, E. R. Edson and Son Co. completed No. 55 on the Ed. G. Miller farm at 480 feet in the Berea Grit. It produced 4 bbls. the first day after shot. In Harrisville Township, the northeast part of Lot 36, C. B. Wood completed No. 10 on the A. D. Falconer farm in the Berea Grit at a depth of 354 feet, showing for 1 bbl. a day after shot. In Grafton Township, E. K. Decker and others drilled No. 5 on the T. B. Foley farm, Lot 63, through the Berea Grit to a depth of 135 feet. The sand was dry.

In Monroe County, James Albright and others drilled a test on the G. C. Burkhart farm in the southeast quarter of Section 21, Sunsbury Township through the Berea sand to 1,876 feet. It was a dry hole.

SOUTHWEST PENNSYLVANIA

There were three gas wells and one small producer completed in Southwest Pennsylvania. The best completion was a test in Fayette County where Stephen Speers and others completed a gas well on the Stephen Speers farm in the northwest corner of Washington Township near Bellevernon. It was drilled in the Elizabeth sand at 2,530 feet and at 2,535 feet, gas was struck. It showed 20 pounds rock pressure in the 6⅝-inch casing when struck which increased to 172 pounds in 10 minutes. The flow gauge showed five inches of water through a 4-inch orifice or about 1,322,000 feet a day, initial.

In Amwell Township, Washington County, the Carnegie Natural Gas Co. completed the second test on the M. Manon farm in the fifth sand at a total depth of 2,965 feet. The top of the fifth sand was at 2,949 feet with oil showing at 2,954 feet. It is showing for about 5 bbls. a day after shot.

In the same township, Union Gasoline & Oil Corp. completed the test on the Ella S. and A. L. Johns farm in the Nineveh Thirty Foot sand with a showing of gas of about 3,000,000 feet a day. This is being tested and if it holds up, the hole will not be deepened.

In Greene County, the Natural Gas Co. of West Virginia completed deepening No. 1 on the Samuel Price farm in Morris Township at a total depth of 2,758 feet. The top of the Fifty Foot sand was reached at 2,620 feet and it extended to 2,671 feet with gas showing at 2,640 feet. The volume is about 47,000 feet a day.

In Amwell Township, Washington County, Carnegie Natural Gas Co. has started deepening the test on the R. M. Carron's farm which was reported as a gas well in the Thirty Foot sand at 2,981 feet but the volume has since declined.

In East Findley Township, Washington County, the Natural Gas Co. of West Virginia has reached 1,980 feet on the P. I. Ealy farm. In West Bethlehem Township, Furman Nuss & Co. have reached 1,850 feet on the Margaret Keys farm.

In South Franklin Township, Washington County, Duquesne Gas Co. is building a rig on the S. A. Dague farm about a half mile west of the Alberta Iams farm and 500 feet northeast of No. 1. In North Franklin Township, E. H. and J. B. Tague have reached 420 feet in No. 13 on the Adaline D. McKennan Estate.

In Cecil Township, Washington County, Amon and Kaufman are down 1,400 feet on the Mrs. M. Winters farm. In this township, E. H. Clay & Son have started drilling on the W. J. Johnston farm. In North Strabane Township, Smith & Co. are building a rig on the Whitmore-Clark lease.

WEST VIRGINIA

Only one producer was completed in West Virginia. In the upper end of Pike Pool, Clay District, Ritchie County, Lucas & Mahaney completed No. 5 on the J. F. and Laura Kelley farm in the Injun sand at a depth of 1,727 feet. It is a fair producer starting off at 150 bbls. a day. So far all have been fair wells on this farm.

Reconditioning work is still going on. In Central district, Doddridge County, J. D. Foley and others treated No. 3 on the Mary J. Minor farm with acid and it is making 40 bbls. a day.

Gas Wells

In Cabell County, R. H. Adkins and others completed a test on the Golden Cremeans farm in McComas district in the Injun sand at a depth of 1,335 feet. It has an initial volume of 785,000 feet a day.

In Calhoun County, F. F. McIntosh completed the test on the W. E. Stump farm in Lee district in the Injun sand at 2,620 feet. It has a volume of 500,000 feet a day, after shot.

In Clay County, Benedum & Trees drilled the test on the L. E. Rogers farm in Otter district, about a mile south of the dry hole on the Andrew Tanner farm, through the Injun sand to a depth of 2,295 feet. The Injun sand had thinned out to 1,984-2,049 feet and the Berea sand was absent.

In Tyler County, on Long Run of Arnolds Creek in Centerville district, Frank Finley and others drilled No. 4 on the Nathaniel Cain farm to a depth of 2,100 feet, the Big Injun sand. It is a small gas well.

In Wetzel County, C. B. Lewis and others drilled a test on the Nicholas Blatt farm in Proctor district through the Maxon sand to a depth of 2,235 feet. It was a dry hole. The Pittsburgh Coal in this test was at 1,108 feet.

In Wirt County, Glen W. Roberts completed a second test on the W. C. McConaughey farm in Burnings Springs district as a fair gas well. It was completed in the Keener sand and has a volume of 1,000,000 feet a day.

Oriskany Tests

In Elk district, Kanawha County, the test of the Clyde Oil & Gas Co. on the F. W. Shinn farm has reached 4,191 feet with several hundred feet to go to strike the Oriskany sand. As this test is 1,000 feet east of the Copen Heirs failure it is being viewed with interest. On the Mary C. Wingfield farm, Benedum & Trees are down 2,600 feet. On the W. T. and J. H. Goshorn farm, the Yoak Oil & Gas Co. shut down for repairs to the boiler.

In Jefferson district, Kanawha County, the test of Benedum & Trees on the Joseph Hill farm has reached a depth of 1,130 feet.

Drilling in West Virginia

In Boone County, Pure Oil Co. is down 2,701 feet in No. 3 on the A. M. Pricard lease in Sherman district. In the same district, Owenns Illinois Glass Co. has reached 2,240 feet in No. 23 on the Peytonia Coal Land Co. tract.

In Cabell County, only two wells are drilling, both in McComas district. Boyles & Gardner are drilling at 600 feet on the Edward Owens farm, a test, and Fairfax Gas Co. is down 450 feet in a second test on the Leonard Paugh farm.

In Calhoun County, Dudley Lutz and others have started drilling on the Elias Yoak farm in Sherman district. Boyce Fowler and others are down 1,680 feet on the Lowman Fowler farm, same district, and C. B. Lewis and others are fishing the tools at 980 feet on the M. J. Kight farm. In Center district, Ivy Gainer and others are down 1,375 feet on the Ivy Gainer farm.

In Doddridge County, L. L. Shinn is drilling on the J. R. Hiley farm in Central district and has reached 1,100 feet. In Gilmer County, Steer Creek Oil & Gas Co. is shut down at 1,585 feet on the C. D. Mollahan farm in Center district and is testing the sand. J. W. Cunningham and others have completed the rig on the Lee and Ola Gainer farm in DeKalb district.

In Kanawha County, J. B. Weir has reached 1,630 feet in No. 108 on the Falling Rock C. C. Co. tract in Big Sandy district. In Cabin Creek district, Godfrey L. Cabot, Inc. has reached 2,401 feet and 3,350 feet respectively in Nos. 51 and 52 on the A. D. Huntington lease.

In Logan County, West Virginia Gas Co., is drilling at 2,070 feet in No. 38 on the Dingess Run Coal Co. in Logan district. In Chapmansville district, Cumberland Petroleum Co. has started drilling No. 10 on the Merrell Coal Co. tract.

In Marion County, Monroe & Laughlin have reached 3,360 feet in No. 3 on the A. D. Wells farm in Mannington district. In Marshall County, Samuel Morrison and others are ready with the drilling machine on the Ambrose Ferris farm in Clay district.

In Ritchie County, on Dutchman Run in Murphy district, Pittsburgh Oil & Gas Co. is drilling No. 14 on the Alvin Wince farm. On the same run, W. R. Hays is down 1,300 feet in No. 4 on the Levi Wilson farm. On Bear Run in this district, Patton & Wilson Farm Oil Co. is down 900 feet on the Patton and Wilson farm. One mile southwest of Smithville on Leatherbark Creek, Clem S. Morris is drilling on the H. B. Ayers farm and is down 1,200 feet. In Grant district, Ralph Jackson and others are down 600 feet on the S. and L. Tennant farm. In Clay district, Cottrill and others started the test on the Emma Wince farm and shut down at 200 feet fishing. Smith & Hendershot are drilling at 800 feet in No. 4 on the Charles Wilcox, Sr., farm. Rinehart and others are down 2,130 feet on the A. J. Glass farm.

In Tyler County, Cease Baker and others have reached 500 feet on the Armstrong Smith farm in Ellsworth district. In Meade district, Smith & Kerns are fishing at 1,500 feet on the I. T. Hill farm. In Wood County, John Leaton & Herbert Flanigan are moving in a machine on the E. G. Moorehead farm in Walker district about 800 feet south of the No. 1 on the Sarah Lemley farm.

Administrator's Report on Crude Stocks

WASHINGTON, D. C., Mar. 25.—Stocks of domestic and foreign crude petroleum at the close of the week ended March 16 totaled 322,176,000 bbls., according to data compiled by the Bureau of Mines, Department of the Interior, for Petroleum Administrator Harold L. Ickes. In comparison with data for the previous week, this total represents a net increase of 128,000 bbls., comprising a decline of 36,000 bbls. in stocks of domestic crude oil and an increase of 164,000 bbls. in foreign crude stocks.

Current reports of the industry indicate that crude oil production showed another material gain, the daily average for the week ended March 16 being approximately 2,655,000 bbls., an increase of 70,000 bbls. over the average of the previous week. All the major producing states increased their output, the largest gain being registered in Oklahoma. Daily average imports were 64,000 bbls. as compared with an average of 53,000 bbls. for the previous week. The daily average crude runs to stills was 2,540,000 bbls., indicating a material increase in refinery operations. The estimated daily average balance of crude oil for the week ended March 16 was as follows (barrels): Production, 2,655,000; imports, 64,000, equals runs to stills, 2,540,000; increase in stocks, 18,000; exports, fuel, and losses, 161,000.

STOCKS OF CRUDE PETROLEUM, MARCH 9 AND 16, 1935
(Barrels of 42 gallons)

Grade of crude oil—	Mar. 9	Mar. 16
Pennsylvania Grade	4,375,000	4,371,000
Other Appalachian	910,000	938,000
Lima-N.E. Indiana-Michigan	1,181,000	1,165,000
Ill.-S.W. Ind.	11,531,000	11,485,000
N. La. and Ark.	9,543,000	9,751,000
W. Tex. and S.E. N. Mexico	30,454,000	30,434,000
East Texas	30,063,000	29,786,000
Other Mid-Continent	148,076,000	147,818,000
Gulf Coast	20,248,000	20,289,000
Rocky Mountain	27,646,000	27,651,000
California	34,589,000	34,892,000
Domestic crude	318,616,000	318,580,000
Foreign crude	3,432,000	3,596,000
Total*	322,048,000	322,176,000

*Represents approximately 98 per cent of total stocks in the United States, exclusive of producers' stocks.

Four Completions All Dusters in North Louisiana; Two Oil Wells and a Gas Well in Arkansas

By J. R. CRUMPTON
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., Mar. 25.—The four completions reported in the North Louisiana district during the week were all dusters, but Arkansas came through with two oil wells and one gasser out of as many finished wells. Wildcat activity in both districts was given added impetus by the announcement of a number of new blocks in widely separated areas.

NORTH LOUISIANA

Two of the dry holes in this district were old wells which have been shut down as temporarily abandoned since the middle of last year. In the Converse area of Sabine Parish, Erle P. Halliburton's No. 1 C. C. Raymond, Section 8-9-13, was abandoned with a slight show of oil from 2,080 feet. On the eastern flank of the Zwolle Field, H. C. Maulding's No. 2 De Latin, Section 3-7-11, was abandoned as dry at 2,587 feet. In DeSoto Parish, a few miles north of the town of Mansfield, Dempsey-Manziel's No. 1 T. D. Thigpen, Section 33-13-13, failed to make a commercial well and was abandoned in chalk rock at 1,745 feet. The test was treated with acid on two occasions, and pumped considerable oil with salt water. It is reported the operators will rig up on a second well in the immediate vicinity during the coming week. On the southeast edge of production in the old Caddo producing area, Simplex Oil Co.'s No. 1 W. E. Glassell, Section 36-20-15, was a duster and abandoned at 2,440 feet.

Of the new operations announced recently, several of them are wildcat tests of more than passing importance. In the northern part of Bossier Parish, Plain Dealing Syndicate has derrick up on its No. 1-A Bollinger in Section 31-23-12. The test is about 2 miles northeast of a recently completed wildcat which was dry around 3,200 feet but which developed enough show to warrant more drilling in that area. All of the wildcats drilling in this area of Bossier are looking primarily for Blossom sand production. In the northeastern part of the State in Madison Parish, one wildcat is rigging up, and another large block has been assembled with a drilling contract. Frazier and others' No. 1 Frazier, Section 23-17-10e, which is rigging up, is in the northwestern part of Madison Parish near the town of Delhi. J. G. Reaves, W. F. Bridewell and Bob Hutchins of Tyler, Tex., have taken over 20,000 acres of an original block of 150,000 acres assembled by George T. Shaw. The block centers around Section 1-17-12e, and the contract calls for a 4,500-foot hole to begin by April 15. In the northwestern part of DeSoto Parish, near the Caddo Parish line, E. B. Bird and others' No. 1 A. D. Johns, Section 20-14-6, has set 10-inch surface casing at 22 feet and is drilling at 450 feet. This wildcat is located on a block of 4,500 acres and plans to drill to the Woodbine sand. A new test recently staked in the western part of Webster, Virgil Likens' No. 1 E. L. Stewart, Section 23-18-10, has spudded in and set 10-inch surface casing at 41 feet.

Old Spider Field

It is reported that the old Spider Field in DeSoto Parish will get a number of tests by a recently organized company from South Louisiana. Dudley J. LeBlanc, E. L. Foster and associates' No. 1 Youngblood, Section 9-11-14, an old well drilling deeper, is drilling at 2,385 feet, and it is reported two more wells will be drilled in this area after the first test is finished. In the Sligo gas area of Bossier Parish, Arkansas-Louisiana Gas Co. is rigging up on its No. 2 R. O. Roy in Section 18-17-11. The new operation is about one-half mile north of No. 1 R. O. Roy, recently completed as a 41,000,000-foot gas well from 2,799 feet which extended this producing horizon in the Sligo area, 1½ miles to the east. The shallow gas producing area in the Blanchard Field, Caddo Parish, may be extended about 1½ miles northeast by Louana Oil & Gas Co.'s No. 1 W. H. Lindsey, Section 35-19-16, which is rigging up.

None of the drilling wildcats in the North Louisiana district developed anything of interest during the week, but several are being closely watched for developments in the immediate future. Saline Drilling Co.'s No. 1 Pardee, Section 27-14-6, Bienville Parish, is drilling at 3,467 feet after encountering a show of gas from 4 feet of sand around the 2,900-foot level. Other wildcats in this district follow: Bossier Parish, W. A. Kirkland's No. 1 Jarrett & McKeller, Section 3-21-13, drilling in shale at 1,310 feet; Ouachita Parish, J. E. Farrell and others' No. 1 State of Louisiana, Section 49-20-4e, set 12½-inch at 150 feet, 8¼-inch at 802 feet and drilling at 2,000 feet; Rapides Parish, C. D. Loe's No. 1 Baird estate, Section 40-5n-1w, is still fishing for 4,000 feet of drill stem from a total depth of 4,375 feet, and Williams, Carroll & Day's No. 1 Armstrong & Murphy, Section 24-5n-1w, has set 10-inch surface at 80 feet and drilling at 800 feet. Caddo Parish, original producing area in North Louisiana, has taken the lead from other parishes in this area in active drilling operations with more than 20 rigs running, most of which are in old proven areas or recently extended production from old fields.

Wildcat Operations in Louisiana-Arkansas

(Rotary operations unless otherwise designated)

NORTH LOUISIANA

AVOYELLES PARISH

Bell Oil Co.'s No. 2 Thompson-Koltz, 450 ft. S, 350 ft. E, NW cor. Sec. 11-2n-5e.
Rigging up.

Southern Star Pet. Co.'s No. 1 O. G. Boyette, Sec. 28-3-5e.
S.D. 3,421 ft.

BIENVILLE PARISH

Saline Drlg. Co.'s No. 1 Pardee, Sec. 27-14-6.
Drlg. 3,467 ft.

BOSSIER PARISH

W. A. Kirkland's No. 1 Jarrett & McKeller, 330 ft. N and W, S cor. NW NW Sec. 3-21-13.
Drlg. 1,310 ft.

Leonard Co.'s No. 1 Pearson, 250 ft. S and E, of C Sec. 22-21-14.
S.D. for fuel 2,408 ft.

Plain Dealing Synd.'s No. 1-A Bollinger, Sec. 31-23-12, 330 ft. N and E SW cor. SE NW.
Location.

Scott & Howard's No. 1 Sherrill, Sec. 13-19-12.
Partly rigged up and S.D.

R. L. Skidmore et al's No. 1 Davis, Sec. 12-18-13.
S.D. 1,150 ft.

CADDO PARISH

Alaska Oil Corp.'s No. 1 Dickerson, 150 ft. N and E, SW cor. NW NW.
Drlg. 1,005 ft.

Ark.-La. Gas Co.'s No. 2 Rodessa O. & Devel Co., Sec. 23-23-16.
Drlg. 5,280 ft.

J. Ed Bailey, tr.'s No. 1 Hartzo, NW cor. NE NW Sec. 28-22-16.
Drlg. 1,235 ft.

W. T. Bell et al's No. 1 Bostick, 1,320 ft. E. 660 ft. N. SW cor. Sec. 12-22-16.
Fishing for bailer 2,754 ft.

Cal.-La. Devel. Co.'s No. 1 Glassell, NW NE Sec. 11-19-15.
Set 10-in. 40 ft.

Gulf Ref. Co.'s No. 8 Chew, 100 ft. N, 400 ft. E, C Sec. 33-21-16.
W.O.S.R. 1,825 ft.

Hillman et al's No. 1 J. S. Noel Est., NE NE Sec. 12-20-16.
Rigged up and S.D.

A. D. King, tr.'s No. 1 Roach, 641 ft. E, 375 ft. N, SW cor. SE Sec. 4-14-16.
S.D. 2,128 ft.

Press & Lambert's No. 1 Hughes, Sec. 15-20-15.
W.O.S.R. 2,201 ft.

Press & Lamberts' No. 1 Robertson, 300 ft. N and E, SW cor. SE Sec. 15-20-15.
Set 10-in. 40 ft.; drlg. 1,200 ft.

Recovery Oil Co.'s No. 1 W. L. Sibley, Sec. 15-19-14.
Fishing for D.S. 2,050 ft.

A. C. Scott et al's No. 1 Noel Est., 330 ft. S and E, NW cor. Sec. 22-20-15.
Coring 2,205 ft.

Simplex Oil Co.'s No. 1 W. E. Glassell, 660 ft. N and W, SE cor. Sec. 36-20-1s.
Dry and abd. 2,440 ft.

G. R. Stevens' No. 2 Hart, Sec. 22-21-16.
10-in. 20 ft.; set 6-in. 1,017 ft.

Texas Co.'s No. 3 School fee, Sec. 16-20-15.
Tested dry 2,222 ft.; arranging to deepen.
W.O.S.R. 2,222 ft.

Texas Co.'s No. 4 School fee, Sec. 16-20-15.
Set 10-in. 100 ft.; set 6-in. 2,159 ft.

C. A. Tooke's No. 1 fee, 104 ft. S and W, NE cor. SE Sec. 16-20-15.
Set 7-in. 2,168 ft.

Tooke & Reynolds' No. 2 Levy, 300 ft. S and E, NW cor. SE NE Sec. 16-20-15.
Set 10-in. 40 ft.

V. & F. Oil Co.'s No. 2 Ethison, Sec. 16-20-15.
W.O.S.R. 2,203 ft.

CATAHOULA PARISH

Phillipe et al's No. 1 Central Lbr. Co., Sec. 2-9-6e.
Arranging P.B. from 3,016 ft.

CLAIBORNE PARISH

J. C. King's No. 1 Odes Webb, 330 ft. S and E, NW cor. NW NE Sec. 21-21-8.
S.D. 1,710 ft.

E. T. Oakes' No. 1 H. W. Patton Est., 660 ft. S and W, NE cor. Sec. 1-20-5w.
Rigging up.

DESOTO PARISH

E. B. Bird et al's No. 1 A. D. Johns, 330 ft. N and W, center Sec. 20-14-6.
Set 10-in. 22 ft.; drlg. 450 ft.

Century O. & Drlg. Co.'s No. 1 Morton, 300 ft. N and E SW cor. SE NE Sec. 27-11-14.
S.D.; W.O. 2,825 ft.

G. O. Collins' No. 1 J. H. Riggs, 450 ft. S and W, NE cor. SW Sec. 21-14-13.
Set 10-in. 40 ft.

Dempsey & Manziel's No. 1 Thigpen, 375 ft. S, 330 ft. W, NE cor. SW NE Sec. 33-13-13.
Dry and abd. 1,745 ft.

DeSoto Pet. Co.'s No. 1 B. Y. Wemple, C S½ SE NE SW Sec. 14-12-11.
S.D.; repairing rig; 2,110 ft.

E. L. Foster's No. 1 Youngblood, Sec. 9-11-14.
Drlg. 2,385 ft.

P. G. Fraley et al's No. 1 G. R. Stell, 330 ft. S and W, NE cor. Sec. 5-12-16.
Rigging up.

Hester et al's No. 1-A T. R. Alston, 360 ft. S, 330 ft. W, C Sec. 11-11-16.
S.D. 2,480 ft.

Leslie Prod. Co.'s No. 1 Ramsey, 150 ft. N and W of C Sec. 36-11-11.
Se' 10-in. 45 ft.

C. T. Ruffin's No. 1 J. M. Nabors, 300 ft. S and E, NW cor. SW Sec. 32-13-11.
Drlg. 2,775 ft.

Ben F. Smith's No. 1 Bonds, 700 ft. E, 500 ft. N, SW cor. Sec. 23-12-11.
S.D. 2,749 ft.

National Oils, Inc.'s No. 1 B. Y. Wemple, NW SW Sec. 14-12-11.
S.D. 120 ft.

EAST CARROLL PARISH

Century Oil & Drlg. Co.'s No. 1 Olive Dell, 660 ft. S, 300 ft. W, NE cor. Sec. 56-21-21e.
S.D. 150 ft.

GRANT PARISH

C. & S. Oil Corp.'s No. 1 Swope, Sec. 17-19-1e.
Rigging up

LA SALLE PARISH

F. A. Trichello's No. 1 Urania, Sec. 3-9-1e.
S.D.; junked hole 1,491 feet.

NATCHITOCHES PARISH

Clyde Crichton's No. 1 Friedman Est., 406 ft. N, 428 ft. E, SW cor. Sec. 52-7-6.
S.D. 2,934 ft.

Missouri Drlg. Co.'s No. 1 Brown Lbr. Co., 400 ft. N, 330 ft. W, SE cor. Sec. 5-10-10.
S.D. 1,033 ft.

Roy A. Raines et al's No. 1 Raines est., 330 ft. N and E, SW cor. Sec. 8-9-10.
Fishing for D.S. 3,540 ft.

OUACHITA PARISH

J. F. Farrell et al's No. 1 State of La., 3,345 ft. N, 2,013 ft. W, from common cor. Sec. 49-20-4e.
Set 12½-in. 150 ft.; set 8-in. 802 ft.; drlg. 2,000 ft.

RAPIDES PARISH

C. D. Loe, trustee's No. 1 Baird Est., SE cor. Sec. 40-5n-1w.
Fishing for D.S. 4,290 ft.

Williams-Carroll & Day's No. 1 Armstrong & Murphy, 286 ft. N, 300 ft. W, SE cor. Sec. 24-5n-1w.
Set 10-in. 80 ft.; drlg. 800 ft.

RED RIVER PARISH

J. S. Tuffree's No. 1 Wilkinson, 1,320 ft. S and W, NE cor. Sec. 11-12-11.
S.D. for fuel 1,330 ft.

SABINE PARISH

H. J. Brothers et al's No. 1 Edwards, 300 ft. S and W, NE cor. SW NW Sec. 29-9-13.
Bailing to test 2,015 ft.

Crescent Drlg. Co.'s No. 3 Garner, Sec. 8-7-11.
Location.

M. T. Hines' No. 1 J. B. Hill, SW NE Sec. 4-6-11.
Drlg. 900 ft.

Helena Oil & Gas Co.'s No. 1-B Graham, 330

(Continued on Page 171)

ARKANSAS

The most important development in this district was the completion of Joe Modisette's No. 1 L. Hill in Section 6-18-13, about 3 miles west of the Urbana Field in Union County. The well gauged 3,500,000 feet of gas with 975 pounds rock pressure from 2,565 feet. The gasser is in what is known as the old Lawson area where a structure is known to have existed with a number of wells drilled with various showings in the past. The new production is coming from the Blossom horizon. The Urbana Field produces a low grade oil from the 3,600-foot level. About 1 mile south of the new gasser, Modisette and others' No. 1 J. M. Gibson, Section 6-18-14, cored sand from 2,526-36 feet and arrangements are being made to test from the total depth.

The Rainbow Field reported two producers. Alice-Sidney Oil Co.'s No. 1-B E. F. Gregory, Section 10-17-14, is flowing 822 bbls. daily through 2-inch tubing from 3,377 feet. The well is an extension of one-fourth of a mile southwest. The other producer was from the same area of the field. J. E. Crosbie, Inc.'s No. 2-A E. F. Gregory, Section 10-17-14, is pumping 265 bbls. daily from 3,361 feet.

Two deep tests in Union County fields, one in the Rainbow Field and the other in the Smackover area, are making fair progress. In the former, H. L. Hunt, Inc.'s No. 15 E. F. Gregory, Section 10-17-14, cored 3 feet of hard sand from 4,762-65 feet. Gulf Refining Co.'s No. 49 L. Werner, Section 5-16-16, Smackover Field, set 10-inch casing at 2,293 feet and is drilling at 2,991 feet.

Daily Production

Estimated daily gross production of all companies for week ending March 22 follows:

NORTH LOUISIANA

	Bbls.
Bellevue	725
Caddo light	4,965
Caddo heavy	1,980
Converse	1,025
Cotton Valley	460
DeSoto and Red River	1,435
Elm Grove	410
Haynesville	3,600
Holly	165
Homer	2,700
Pleasant Hill	195
Sarepta-Carterville	525
Urania	3,100
Zwolle	1,775
Total	23,060

SOUTH ARKANSAS

Champagnolle	3,050
El Dorado	2,180
Lisbon	320
Miller County	1,545
Nevada	890
Smackover light	2,195
Smackover heavy	17,980
Stephens	505
Urbana	2,150
Total	30,815

Passage of Five Per Cent Gross Production Tax Week's Important Oklahoma Development

By JAMES McINTYRE

The most important news emanating from the Oklahoma State legislature the past week was passage of the 5 per cent gross production tax bill by both bodies of the legislature. The bill was passed by a substantial majority with the emergency clause attached and no provision for a time limit, thereby taking on the aspect of a permanent law. The bill raised the tax from 3 per cent to 5 per cent.

Simpson Sand Discovery

Surrounded by dry holes on three sides and about 1 mile west of a small Sonora lime producer, Wofford Drilling Co. has uncapped a Simpson sand discovery in its No. 1 Thomas, NW SE Section 8-6-7e, Seminole County. Topping Simpson dolomite formation at 3,890 feet, 7-inch casing was set at 3,881 feet, cement plugs drilled and total depth at 3,917 feet the hole filled with oil, making one flow of 125 bbls. in 30 minutes. It was shut in awaiting erection of tankage. Production tests will be conducted and the well deepened if thought advisable.

Pool Production

Estimated production by pool in Oklahoma for the week ended March 23 and for the preceding week follows:

	Barrels	
	Mar. 23	Mar. 16
Allen	8,476	8,325
Asher-West Asher	1,350	1,425
Burbank	8,500	8,500
South Burbank	10,000	10,000
Balance Osage	27,500	27,500
Blackwell	4,800	4,700
Bristow-Slick	9,500	9,500
Chandler	5,750	5,750
Crescent	5,225	4,350
Cromwell	4,300	4,300
Cushing-Shamrock	13,100	13,100
Duncan district	4,050	4,350
Edmond	1,200	1,200
Fish	8,225	8,525
Fitts	12,825	12,175
Gray	1,950	2,025
Graham	3,800	3,650
Healdton	8,900	9,000
Hewitt	4,750	4,800
Holdenville	1,900	1,900
Keokuk	2,075	2,550
Konawa	2,575	2,325
Lucien	11,400	9,725
Marshall-Lovell	900	850
Oklahoma City	162,975	162,900
Papoose	1,300	1,300
Polo	4,200	3,725
Sasakwa and Townsite	2,725	2,825
Sholem-Alechem	3,950	4,500
Seminole Field:		
Bowlegs	12,575	11,500
Carr City	6,775	6,850
Earlsboro	8,850	9,100
East Earlsboro	8,975	9,025
South Earlsboro	1,125	1,000
Little River	14,450	13,725
East Little River	900	875
Maud	1,800	1,875
Mission	3,425	3,200
Seminole	11,700	11,275
East Seminole	1,200	1,175
Searight	4,125	3,800
Total Seminole	75,700	73,400
St. Louis-Pearson	25,075	26,425
Tatums	5,250	5,600
Tonkawa-Garber-Thomas	6,050	6,000
Wewoka	3,800	3,800
Yale-Jennings	4,800	4,500
Other pools	55,671	55,009
Total Oklahoma	514,547	510,809

Pontotoc County

An encouraging strike in eastern Pontotoc County, about 12 miles northeast of Ada and in the old Steedman shallow sand pool, was made by Radial Oil Co. in its No. 1 Simpson, NE NW NE Section 20-4n-8e. In a spot that has been producing for several years from sand around 700 feet this test ventured to new horizons and uncovered what some think is the lower Boggy formation at 1,524 feet. At 1,528 feet the hole filled up with oil and two small flows were made before it was shut in for tankage. The importance of production in this well is significant in that quite an area of untested territory surrounds it.

In the Fitts Pool of Pontotoc County, Burke-Greis' No. 1 Chambers, NE NW Section 32-2-6, extended production of the pool one-quarter mile southwest. Bromide was topped at 4,330 feet and at 4,444 feet, total depth in sand, it flowed an estimated 800 bbls. the first hour and was then shut in.

Ed Moore and others' No. 2 Akers, SE NW NE Section 36-2n-6e, extended the Fitts Pool one-quarter mile south when it flowed 1,930 bbls. the first three hours through casing. Bromide topped at 4,215 feet, first sand 4,325 feet, second sand 4,410 feet and total depth 4,432 feet.

Phillips Petroleum Co.'s No. 2 T. Norris, SE NE SW Section 25-2-6, Fitts Pool, was completed for 877 bbls. the first hour flowing through casing. Bromide 4,085 feet, first sand 4,180-4,210 feet, second sand 4,257-99 feet, total depth.

Ed Moore and others' No. 4 Smith-B, NE cor. Section 36-2-6, logged bromide 4,125 feet, first sand 4,235 feet, second sand 4,290 feet, McLish lime 4,350-57 feet, total depth, and it flowed 770 bbls. in one hour through casing and was then shut in.

North of the Fitts Pool proper in Pontotoc County, George Manahan and others' No. 3 Reynolds-Wagner, NE SE Section 18-2-7, found broken Booch sand from 1,800-16 feet, total depth, swabbing 45 bbls. in eight hours.

E. H. Moore and others' No. 1-A Showers, NW SW NW Section 29-2-7, on the east side of the Fitts Pool, was completed for 804 bbls. first hour flowing through casing. Bromide 4,060 feet, first sand 4,165 feet, second sand 4,240 feet, McLish lime 4,283-87 feet, total depth.

Carter Oil Co.'s No. 4 Hardin, SW NE SW Section 30-2-7, was a completion. Bromide lime logged at 3,900 feet. first sand 4,015 feet, second sand 4,055 feet, McLish lime 4,110-25 feet, total depth. Flowing through casing it made 667 bbls. the first hour and 558 bbls. the second hour. Same company's No. 5 Richards, SW NW SE Section 30-2-7, Fitts Pool, found bromide lime 3,945 feet, first sand 4,130 feet, second sand not recorded, McLish lime 4,165-80 feet, total depth. This well had an estimated 8,000,000 feet of gas and flowed 675 bbls. of oil first hour and 558 bbls. of oil the second hour through casing.

Carter Oil Co.'s No. 6 Richards, SE NW SE Section 30-2-7, Fitts Pool, was completed for 1,034 bbls. first two hours flowing through casing. Bromide lime 3,970 feet, first sand 4,085 feet, second sand 4,131 feet, McLish lime 4,185-4,200 feet, total depth.

Carter Oil Co.'s No. 7 Richards, SW NE SE Section 30-2-7, Fitts Pool, found bromide lime at 3,950 feet, first sand 4,050 feet, second sand 4,120 feet, McLish lime 4,165-88 feet, total depth, flowing 1,117 bbls. first two hours through casing for its completed gauge. Same company's No. 8 Richards, NE SE Section 30-2-7, Fitts Pool, flowed 1,302 bbls. first two hours through casing. Bromide lime was logged at 4,000 feet, first sand 4,105 feet, second sand 4,180 feet, McLish lime 4,213-29 feet, total depth.

Magnolia Petroleum Co. got a comparatively light well in its No. 4 Hardin, SW NE NW Section 30-2-7, Fitts Pool. Bromide lime was encountered at 4,185 feet, and total depth was 4,273 feet. Sand records not available. The well flowed 42 bbls. per hour on its initial gauge. Rig had been moved away and H. M. Marcum's No. 1 Manguson, SW SE SE Section 23-2-7, was temporarily abandoned at a total depth of 1,930 feet. This was a wildcat location in Pontotoc County, about 4 miles east of the Fitts Pool.

Northwestern Fields

Marathon Oil Co.'s W'lcox sand discovery east of Perry in Noble County, No. 1 Gilbert, Section 24-22-2e, completed three months ago for 318 bbls. initial 24-hour production, is reported holding up favorably and making around 200 bbls. of oil per day. Marathon had staked the first offset location to its discovery well, it being No. 1 Benight, SW cor. Section 19-22-3e, and rig was being built.

Twin State Oil Co.'s No. 3 DeVore, SW NE NW Section 27-22-2w, Polo Pool of western Noble County, had first Wilcox at 4,875 feet and at 4,934 feet, total depth, in second Wilcox sand flowed 300 bbls. of oil in four hours.

In northwestern Noble County, Herndon Drilling Co.'s No. 1 Allen, NE NE SW Section 34-24-2w, logged top of Mississippi lime at 4,710 feet and was drilling at 4,800 feet.

Osage County

The only interesting news relative to Osage County activity coming to attention the past week was the completion of Midco Oil Co.'s No. 6 Adlum, SW SW NW Section 10-25-6, which topped Burbank sand at 2,712 feet, first oil 2,722 feet, and at total depth of 2,770 feet in sand, flowed 3,000 bbls. of oil the first 24 hours. Same company's No. 7 Adlum, NW cor. Section 10-25-6, had rigged up cable tools to drill in at a total depth of 2,624 feet on top of Burbank sand.

Phillips Petroleum Co.'s No. 5 Bean, SW SE NW Section 15-25-6, South Burbank Pool, shut in since last summer, had drilled into Burbank sand topped at 2,775 feet and a total depth of 2,822 feet filled 1,500 feet with oil. It was then shut in.

Following on the heels of the develop-

Wildcat Operations in Oklahoma

Week Ending March 23

NORTHERN OKLAHOMA

BECKHAM COUNTY

Fred Coogan et al's No. 1 Shelton, SW cor. Sec. 33-10-25w.
Drlg. 2,895 ft.

CADDO COUNTY

H. W. Lee et al's No. 1 Horton, NE NE NE Sec. 9-6-13w.
Cellar.

H. W. Lee et al's No. 1 Stacey Ferrell, SW NE NE Sec. 3-6-13w; (2,000-ft test)
Lowering 8-in. csg. 2,003 ft.; showing of oil at 1,960-2,003 ft.; S.D.

Denver Prod. & Ref. Co.'s No. 1 Noe, NW SW SW Sec. 34-10-10w.
T.D. 11,230 ft.; C.O. to 10,000 ft.; flowing by heads 100 bbls. oil every other day.

CLEVELAND COUNTY

Sinclair Prairie et al's No. 1 Franklin, SE NW SE Sec. 21-10-2w.
Drlg. 4,925 ft.

COAL COUNTY

J. D. Petty Oil Co.'s No. 1 McMillan, SW NW NE Sec. 16-1s-8.
S.D. 1,368 ft.

H. F. Potts' No. 1 Nichols, C SW SW NW Sec. 32-2-9.
Viola lime 1,702 ft.; drlg. 1,818 ft.; no show.

GARFIELD COUNTY

Herndon Drlg Co. et al's No. 1 Allen, NE NE SW Sec. 35-24-3w.
Top Mississippi lime 4,710 ft.; drlg. 4,800 ft.

GARVIN COUNTY

Charles Carter and W. S. Key, Inc.'s No. 1 Wood, C NW SW SE Sec. 5-4-3e.
Set surface pipe.

National Prod. Co.'s No. 1 Littrell, NE NE NE Sec. 31-2-3w.
6⅝-in. csg. 1,244 ft.; drlg. 1,435 ft.

George L. Pace's No. 1 Smith, SW NE Sec. 35-1-1.
Drlg. 1,710 ft.

GRANT COUNTY

Helmerich & Payne's No. 1 Crouse, C NE SW Sec 29-25-8w
T.D. 6,131 ft.; drilled cmt. plug 6,018 ft.; small show of gas.

GREER COUNTY

Morgan et al's No. 1 Carder, C SW SE Sec. 19-4-22w.
Drlg. 400 ft.

HUGHES COUNTY

Amerada Pet. Corp.'s No. 1-A Adams, NE NE SW Sec. 31-9-9.
Hunton 4,023 ft.; Simpson dolomite 4,245 ft.; Wilcox 4,271 ft.; T.D. 4,277 ft.; H.F.W.

Dandridge & Crane's No. 1 Mead, NW NW NE Sec. 17-5-9.
Drlg. 1,285 ft.

Freeman et al's No. 1 Kite, NW NW NE Sec. 8-6-10.
Set 5-in. csg. 593 ft.

KAY COUNTY

Harris & Haun's No. 1 Schuessler, C NW SW Sec. 3-28-2.
Drlg. 3,000 ft.

Ray Oil Co.'s No. 1 Holden, SW SW SE Sec. 14-28-3.
5-in. 2,945 ft.; drlg. plugs.

KIOWA COUNTY

Henson & Patton's No. 1 Beeler, NE cor. Sec. 11-6-15w.
Drlg. 35 ft.

LINCOLN COUNTY

Carter Oil Co. et al's No. 1 McFarland C-38, SW SW NE Sec. 18-13-4.
Drlg. 1,447 ft.

Chester L. Carlock's No. 1 Young, C N½ NW NW Sec. 23-15-5.
Rig

Mid-Continent Pet. Corp. et al's No. 1 Nunn, SE SE NW Sec. 25-15-1.
Location.

Slick-Urschel, Inc.'s No. 1 Miller, NW NW SE Sec. 25-15-3.
Tonkawa sand 3,995 ft.; drlg. 4,870 ft.

Slick-Urschel's No. 1 Miller, NW SE Sec. 25-15-3.
Drlg. 4,640 ft.

LOGAN COUNTY

Shell Pet. Corp. et al's No. 1 Hirzel, SE SW SW Sec. 7-16-2w.
T.D. 6,031 ft. in Wilcox sand; abd.

Sinclair Prairie and Slick-Urschel's No. 1 Koatsch, SW cor. Sec. 23-15-3w.
9-in. csg. cmtd. at 5,227 ft.; drlg. 5,475 ft.

Sinclair Prairie Oil Co. et al's No. 1 School Land, SE cor. Sec. 36-17-1w.
Simpson dense 5,255 ft., T.D.; flowed 293 bbls. in 24 hrs.; top sand at 5,285-90 ft., T.D.; H.F.W.; P.B. with 6 sacks of cmt.

Slick-Urschel et al's No. 1 Pennington, C SW NE Sec. 10-16-1w
Hunton lime 5,295 ft.; coring 5,325 ft.

J. C. Schaffer et al's No. 1 Hammond, SE SE SW Sec. 10-15-4w.
Drlg. 4,653 ft.

McCLAIN COUNTY

C. W. James et al's No. 1 Neal, C NW SE SW Sec. 4-5-3.
Hunton 3,335-37 ft.; running 8-in. csg.

NOBLE COUNTY

Marathon Oil Co.'s No. 1 Gilbert, NE cor. Sec. 24-22-2.
Wilcox sand 4,449 ft.; T.D. 4,480 ft.; flowed 1,792 bbls. in 7 days; may deepen.

OKFUSKEE COUNTY

Amerada Pet. Corp.'s No. 1 Jaynes, NW NW SW Sec. 20-10-10.
Hunton 3,690 ft.; 10,000,000 ft. of gas at 3,704 ft.; Wilcox sand 3,932-50 ft., T.D.; no show.

Mid-Continent Pet. Corp.'s No. 1 Haney, SW SE NE Sec. 24-12-8.
Acidized Wilcox sand 4,125-34 ft.; gas broke in; spraying oil; P.B. to 4,134 ft. and comp. for 15,500,000 ft. of gas.

OKLAHOMA COUNTY

W. H. Atkinson et al's No. 1 Reed, NE cor. Sec. 4-12-3w.
Drlg. 3,400 ft.

Anderson & Kerr et al's No. 1 Linn, SW NW Sec. 17-14-2w.
Drlg. 4,735 ft.

Gypsy Oil Co.'s No. 1 Shock, NW SW SW Sec. 2-14-3w.
T.D. 224 ft.; csg. trouble.

R. Carl Larkin's No. 1 Brobine, NW NW NE Sec. 33-13-5w.
Rig and pits.

OSAGE COUNTY

Peters Pet. Co. and Norbla Oil Co.'s No. 1, SW cor. Sec. 15-25-5.
S.D. at 3,134 ft.

PAYNE COUNTY

Marathon Oil Co.'s No. 1 Potts, C SW SW Sec. 27-19-2.
Top Arbuckle 5,085 ft.; T.D. 5,116 ft.; P.B. to 4,550 ft.; set 6-in. 4,489 ft.; drilled plug and got wtr.; P.B. to 4,510 ft.; H. F.W.

(Continued on Page 171)

ment in the South Burbank Pool, an order was issued by the Secretary of the Interior ordering the discontinuance of all new development in the field until May 15.

Logan County

Southeast of Guthrie in Logan County, the wildcat test of Slick-Urschel Oil Co., No. 1 Pennington, C SW NE Section 10-16n-1w, a communitized project, had topped Hunton lime at 5,295 feet and was coring below 5,325 feet in lime.

The most highly touted wildcat venture so far this year, Shell Petroleum Corp.'s No. 1 Hirzel, edging to the west of Guthrie in Logan County, was officially abandoned in second Wilcox sand at a total depth of 6,031 feet.

Lincoln County

Stanolind Oil & Gas Co. had assumed the role of wildcatter and staked location for a test west of Chandler in the SW NW Section 3-14-3e, on a block comprising about 800 acres.

In the Gessman Pool of Lincoln County, Texas Co. completed its No. 2 Coyle, NW SW NW Section 34-14-4e, which flowed 140 bbls. of oil in 24 hours from Cleveland sand logged at 3,045-55 feet, total depth.

Oklahoma County

In the Edmond Pool of Oklahoma County, Continental Oil Co. was running 6-inch casing in its No. 1 Young, SE NW Section 31-14-3w, total depth 6,595 feet in Simpson formation topped at 6,397 feet. Mid-Continent Petroleum Corp. was digging pits for its No. 3 Young in the SW SE NE Section 31-14-3w, Edmond Pool of Oklahoma County.

Permits for the drilling of nine wells in the newly opened extension zone to the Oklahoma City Field had been filed and reports had it Phillips Petroleum Co. planned four wells, Larkin and Warr one well, Westgate Oil Co. two wells and Champlin Refining Co. two wells, two of which were staked during the past week. Champlin Refining Co. had cellar dug for its No. 1 Oak Park, 698 feet east and 1,126 feet north of the SW cor. NW Section 35-12-3w, and Phillips Petroleum Co. had location made for its No. 1 McMullen, 350 feet west and 993 feet north of the SE cor. NE Section 34-12-3w.

Sunray Oil Co., Wirt Franklin Oil Co. and others' No. 1 County, NE NW Section 1-11-3w, Oklahoma City Field, was completed at a total depth of 6,394 feet for 1,480 bbls. of oil. Sand record on this test is not known.

Helmerich & Payne Drilling Co. had completed its No. 1 M.K.&T., NE NW NW Section 3-11-3w, Oklahoma City Field. This test logged Wilcox sand at 6,367 feet and at 6,501 feet, total depth, the 7-inch casing parted and could not be recovered. It was abandoned.

Greater Seminole Area

Mid-Continent Petroleum Corp.'s No. 1 Haney, Okfuskee County wildcat northeast of the Dill Pool, a failure in the Wilcox sand at 4,166 feet, total depth, was completed for 15,000,000 feet of gas and spraying salt water. It had been plugged back to 4,134 feet at which depth gas broke in from behind the pipe.

In the North Searight Pool of Seminole County, Carter Oil Co. and associates had made location for No. 1 Porter in C W half SW NE Section 18-10-6e.

Magnolia Petroleum Corp.'s No. 2 Gates, NE SW NW Section 20-9-5, Earlsboro Pool in Pottawatomie County, had Hunton lime from 4,190-95 feet, total depth, which swabbed 30 bbls. of oil in eight hours. It was a completion.

In the St. Louis sector of Pottawatomie County, Superior Oil Corp.'s No. 2 Ham, NW NE NE Section 5-6-4, was completed in Simpson dolomite formation 4,175-4,227 feet, total depth, for 654 bbls. of oil first 24 hours after acid treatment.

In the southeastern part of the St. Louis Pool of Pottawatomie, Westgate Oil Co. had completed its No. 2 Schrader, SE NW NE Section 6-6-5, in Simpson dolomite encountered from 4,043-95 feet, total depth, swabbing 250 bbls. of oil and some water in its initial gauge. Elbar Oil Co.'s No. 2 Wyatt, SW NW SW Section 10-7-4, (old well drilled deeper) at total depth of 3,803 feet, pumped 40 bbls. of oil in 24 hours. Magnolia Petroleum Co.'s No. 1 Crane, SW SE NW Section 12-7-4, topped Hunton lime at 3,750 feet and at 3,975 feet, total depth was treated with 1,000 gallons of acid which yielded 841 bbls. of oil in 24 hours. In the northwest sector of the St. Louis Pool, Barnsdall Oil Co.'s No. 1 Hubbard, SW NW NW Section 29-8-4, was completed in Hunton lime at 4,342-71 feet, total depth, flowing 837 bbls. of oil in 20 hours after being treated with acid.

In the Little River Field, Pure Oil Co.'s No. 4 Harjo, SE SW NE Section 11-7-6, had been deepened to second Wilcox sand logging same from 4,413-15 feet, total depth, and pumped 100 bbls. oil and 19 bbls. of water in 24 hours. It was a completion.

Mid-Continent Petroleum Corp.'s No. 1 Gassoway, SE NE Section 14-6-5, Grayson Pool in Seminole County, swabbed 205 bbls. of oil in 15 hours in the Simpson dolomite at 3,844 feet, total depth. Simpson dense was topped at 3,728 feet and dolomite at 3,772 feet. It was completed.

Altus District

J. Garfield Buell and others' No. 1 Cole, NE NE NW Section 3-1n-20w, Jackson County, in southwestern Oklahoma, encountered granite wash from 1,455-60 feet, getting a slight show of oil. At 1,550-60 feet it started making about 6 bbls. of water per hour and was shut down for orders at a total depth of 1,601 feet in brown shale. This is an offset to the granite wash producer of Petroleum Products Co.

J. Garfield Buell and others' No. 1 Kizziar, SE NE Section 2-2n-22w, Jackson County, was drilling below 1,000 feet in red beds. Jack Kilgore's No. 1 Wooldridge, SW NE Section 15-3n-21w, Jackson County, was drilling below 1,027 feet with small show of gas at 1,022 feet.

Kiowa County Wildcat

About 18 miles east of Hobart, county seat of Kiowa County, a rank wildcat test had started drilling operations, Henson and Patton's No. 1 Beeler, NE cor. Section 11-6n-15w.

Harmon County

About 10 miles northeast of Hollis in Harmon County and about 15 miles east of the Texas-Oklahoma State line, Wilson & Walker Drilling Co. were rigging up machine for their No. 1 Wilhelm in the SE cor. Section 30-4n-24w, a rank wildcat.

Comanche-Stephens Counties

In the Hanbury Pool of Comanche County, Westheimer & Daube were rigging up on their No. 5 J. Watson, NE cor. Section 24-2n-10w.

William Angle and others had started rigging up rotary tools for their 3,400-foot test, No. 1 Cooper, NE NW NW Section 23-2n-7w, Stephens County wildcat.

Carter County

East of the Tatums Pool in Carter County, Evans and Groves Drilling Co. had abandoned its No. 3 Ratliff, NW SE NW SW Section 28-1s-2w, at 565 feet, total depth. Sand logged at 505-20 feet, carried a small show of oil.

Marshall County

In the Kingman Pool of Marshall County, Charles Newson's No. 5 fee, SE NW SE Section 36-7s-5e, was a completed gas well, gauging 500,000 feet of gas from sands found at 484-502 feet and 509-12 feet. This test was bottomed at 882 feet and plugged back to gas sands.

Three new tests were begun in the Kingman Pool of Marshall County during the week: LeVille Coal Co.'s No. 5 Epler, SE NE NE NE Section 36-7s-5e, machine; same company's No. 1 Godfrey, SW NE NE Section 1-8s-5e, drilling 385 feet, and G. L. Priest and others' No. 3 Cope-Sublett, SE NE SW NE Section 1-8s-5e, drilling 460 feet.

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Importance of Playa Del Rey Field to Be Tested by Operations Now Nearing Completion

By L. P. STOCKMAN
Staff Correspondent, California Fields

LOS ANGELES, Calif., Mar. 25.—A stalemate has been reached in the seamen's strike which has tied up coastwise tanker movement on the Pacific Coast during the past two weeks and departure of the federal mediator for Seattle means that no further efforts to adjudicate the issues involved can be undertaken until he returns. Early this week owners of tankers delivered an ultimatum to striking seamen that they would proceed to transact normal business but further difficulties were encountered when the Masters, Mates and Pilots Union ordered out all of their members on Pacific Coast tankers. Operators of tankers on the Pacific Coast have indicated their willingness to submit all questions to arbitration but the seamen's union will not agree to this until owners of tankers agree to adopt the closed shop principle. Operators of the vessels maintain that since only 519 voted in favor of the International Seamen's Union out of a total of 1,689 seamen they would be forced to discharge a large number of old and trusted employes if they adopted the closed shop.

Early in the week tanker owners informed union officials that "because of your action on March 9, without any notice whatsoever to us in calling a strike on all tankers in the midst of negotiations with you, in spite of the owners' offer to submit all controverted matters to arbitration without limitation, you are hereby notified that all proposals, suggestions and offers made by us, including offers to arbitrate, are withdrawn and that all negotiations between us are now terminated. As a result the tanker owners, much to their regret, are forced to terminate all negotiations, to withdraw all offers of arbitration and to undertake to carry on their regular business." This ultimatum was signed by the Associated Oil Co., General Petroleum, Richfield Oil Co., Union Oil Co., Hillcone Steamship Co., Standard Oil Co. and the Texas Co.

Playa Del Rey

It appears probable that drilling operations in the Playa Del Rey Field of Los Angeles Basin during the next fortnight will permit the formulation of a fairly definite opinion as to the importance and future productivity of the town lot section in the extreme eastern end of the field. Up to the present, development work has been centered in a relatively small area at the extreme western end of the eastern extension of the field with the result that operators are not at all sure just how far east the new section of the Playa Del Rey Field will extend. Not a single well has been finished in the new area beyond a radius of 750 feet from the original extension well and so it is obvious that no one can venture an opinion as to the extent of the new area.

During the current week, Mammoth Oil Co. completed No. 1 Del Rey extension, brought in flowing 8,700 bbls. of clean 22.7 gravity oil and 11,200,000 feet of gas per day from 6,344 feet after the hole had been finished with a 4¾-inch liner carrying 250 feet of perforated. This new producer did not extend the productive area of the field, as it is located between Charles W. Fourl's initial extension well and the Union's No. 7 Vidor. One of the most interesting features in connection with these new wells in the eastern extension is the fact that all wells finished up to the present have shown an abnormally large production of natural gas. None of the older wells in the field showed a gas production comparable with that being developed by recent completions in the newer area and despite the fact that the field limits are still limited this high gas production must have some significance. Many operators do not expect the limits of the field to extend past Manchester Avenue, but this opinion is inconsistent with developments up to the present.

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	March 10—		March 3—			
Intercoastal-domestic—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Fuel oil	.....	.....	.....	.....	.....	3,228,321
Diesel and gas oil	79,659	11,380	54,442	7,777	527,098	493,144
Gasoline	190,704	27,243	75,578	10,797	1,313,077	819,018
Kerosene	4,975	711	142,811	20,402	226,246	303,121
Foreign exports—						
Crude oil	266,108	38,015	67,074	9,582	1,838,530	1,454,593
Fuel oil	238,242	34,035	325,006	46,429	3,596,778	2,125,134
Diesel and gas oil	180,974	25,853	94,580	13,526	570,185	821,708
Gasoline	30,101	4,300	287,023	41,003	827,122	762,591
Kerosene	3,329	476	20,961	2,994	214,801	226,943
Other unfinished oil	.....	.....	.....	.....	37,097	34,363
Coastwise-domestic—						
Crude oil	76,572	10,939	233,520	33,360	1,424,652	1,130,771
Fuel oil	203,410	29,059	167,283	23,898	2,128,672	2,377,735
Diesel and gas oil	47,235	6,748	24,698	3,528	211,867	132,694
Gasoline	286,296	40,899	81,602	11,658	1,729,753	1,822,218
Kerosene	1,114	159	1,921	274	34,598	28,895

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic—						
Diesel and gas oil	79,183	11,312	.....	.....	157,258	313,695
Gasoline	.....	.....	.....	.....	.....	72,625
Kerosene	.....	....	70,610	10,073	149,715	80,925
Asphalt	.....	.....	.....	.....	71,325	.....
Lubricants	.....	.....	8,376	133	12,381	8,310
Foreign exports—						
Crude oil	175,596	25,082	.....	.....	533,081	443,002
Fuel oil	26,177	3,740	90,892	12,985	335,798	176,487
Diesel and gas oil	.....	.....	51,055	7,294	125,612	330,580
Gasoline	.....	.....	152,495	21,785	627,812	565,907
Kerosene	.....	.....	43,350	6,193	121,016	131,662
Lubricants	.....	.....	22,130	3,161	44,246	21,460
Coastwise-domestic—						
Fuel oil	147,196	21,028	30,086	4,298	747,591	695,769
Diesel and gas oil	32,194	4,599	36,978	5,283	79,662	50,785
Gasoline	14,718	2,103	215,675	30,811	772,672	586,181
Kerosene	.....	.....	4,071	582	10,149	24,721

Dominguez

Shell Oil Co. added a new well to its list of producers in the Dominguez Field of Los Angeles Basin this week by completing No. 64 Reyes flowing 1,540 bbls. of clean 30.5 gravity oil per day from 4,604 feet. This well will be followed into completion by three wells which the Union Oil Co. is drilling on the Callender, Carson and Hellman leases. In the Long Beach Field the San Andreas Oil Co. completed No. 1 Signal, a new well, and increased its production by 215 bbls. per day. This well was bottomed at 4,262 feet and brought in on the beam. The Bernal Oil Co., which recently finished a fairly good pumper, has staked location for No. 4, which will be drilled in close proximity to No. 3 Signal.

It has been a long time since the Santa Fe Springs Field occupied a prominent spot in the limelight but if reconditioning work keeps up at the present rate it will be impossible to overlook future work. The Union has been concentrating a lot of work in this field where it has a considerable amount of undrilled acreage which must be drilled up before the company will be given any credit as far as allowable production is concerned. The company had hoped that this undrilled acreage might be reserved for the future but is unable to keep it in reserve. This is just another instance of unnecessary waste. In other words, no consideration is given to future reserves and if you finish an 8,000-bbl. well you are given an allowable of 350 bbls. per day. During the early part of the current week, General Petroleum recompleted No. 46-A Santa Fe in the Santa Fe Springs Field, which was returned to production doing 244 bbls. of clean 32.5 gravity oil per day on a compressor after the hole had been redrilled and deepened to 5,495 feet.

Inglewood

Development work in the Inglewood Field of Los Angeles Basin has not shown any great change despite the fact operators are privileged to undertake additional drilling. Standard Oil Co. has three drilling projects under way in this field at present and has a similar number rigged up for work at some time in the future. Associated Oil Co. is redrilling and deepening No. 32 Vickers to the Machado zone and is building rig for No. 60 Vickers which will be carried down to the Rubel horizon. In the West Coyote Field of Los Angeles Basin, the Standard Oil Co. completed No. 120 Murphy-Coyote at 6,000 feet, finished with a 6⅝-inch liner carrying 850 feet of perforated, and was brought in flowing 1,180 bbls. of clean 29.7 gravity oil per day. The Standard has two other drilling projects under way in this field at present.

The Montebello Field of Los Angeles Basin is still an enigma and will remain so until the Universal Consolidated or some other operator proceeds with work and outlines what it is all about. Right now it is anyone's guess and every one is sitting tight. The Union Oil Co. has indicated that it will proceed with extension work provided that the holders of leases come down to earth.

The Huntington Beach Field has shown a little increase in drilling, but this represents a normal condition where certain remedial work and new drilling is required from time to time. Over in the Rosecrans Field of Los Angeles Basin, A. N. Macrate is preparing to make a production test of his No. 1 Gray, which has been redrilled and deepened to 6,464 feet, and the outcome of this test may prove to be of more importance than some anticipate. This new well has been bottomed in the deep zone and if commercial production is developed will precipitate additional work.

Lost Hills-Belridge

Up in the North Belridge Field of Kern County the Belridge Oil Co. finished No. 16-35 flowing 360 bbls. of clean 34.3 gravity oil, and No. 22-35 flowing 2,160 bbls. of 40.1 gravity oil and 3,000,000 feet of gas per day. The former was finished at 8,538 feet after the hole had been plugged back from 8,905 feet while the latter was bottomed at 5,465 feet and finished with a 6⅝-inch liner carrying 521 feet of perforated. No. 16-35 proved to be Belridge Oil Co.'s jinx well as it encountered a number of delays during the last several months. Early in December, 1934, this new well came in flowing 5,000 bbls. of hot salt water per day and this necessitated plugging back. The plug put at 8,538 feet did the trick because the well is now producing an exceptionally clean grade of oil. Union Oil Co.'s No. 18 Belridge, a recent completion in the North Belridge Field, showed a potential daily production of 5,310 bbls., but has been beaned back to 411 bbls. per day.

The San Joaquin Valley is gradually showing a larger increase in development work and this may become of more importance within the next few months. The Midway-Sunset and Mount Poso Fields are showing greatly increased

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S. T. R.	Depth	Status—
Macrate, A. N., No. 1 Athens, Los Angeles Co.	18- 3-12	6,397	O.S. drlg.
Republic Pet., No. 1 Lawndale, Los Angeles Co.	18- 3-14	3,570	sd. sh. drlg.
Associated Oil Co., No. 2 Inglewood Deep, Los Angeles Co.	7- 2-14	3,000	sd. sh. drlg.
Standard Oil Co., No. 4 Inglewood Deep, Los Angeles Co.	17- 2-14	3,666	cmtd. 3,619
Standard Oil Co., No. 5 Inglewood Deep, Los Angeles Co.	17- 2-14	6,250	br. sh. drlg.
Ohio Oil Co., No. 16 Del Rey, Los Angeles Co.	28- 2-15	3,855	cmtd. 3,488
Bel-Mar Oil Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	181	suspended
Elliott, D. W., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,350	prod. test
Pacific Drlg. Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,282	redrlg. 5,980
Mammoth Oil Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,344	flow 5,000 b.d.
Fourl, C. W., No. 3 Del Rey, Los Angeles Co.	27- 2-15	6,411	redrlg. 5,430
Ritelube Oil Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	3,850	sd. sh. drlg.
Mathews Pet. Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	5,460	rigging up
Royalty Service Corp., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,320	cmtd.
Lor-Mar Oil Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	3,680	sd. sh. drlg.
Schirm & Thayer, No. 1 Del Rey, Los Angeles Co.	27- 2-15	....	bldg. rig.
Union Oil Co., No. 8 Del Rey, Los Angeles Co.	27- 2-15	750	cmtd.
Union Oil Co., No. 9 Del Rey, Los Angeles Co.	27- 2-15	6,180	sd. sh. drlg.
Union Oil Co., No. 10 Del Rey, Los Angeles Co.	27- 2-15	750	suspended
Big Ben Oil Co., No. 1 Del Rey, Los Angeles Co.	27- 2-15	6,758	suspended
Doyle Pet. Co., No. 1 Manhattan, Los Angeles Co.	30- 3-14	6,341	hd. sd. drlg.
Severns Drlg. Co., No. 1 Torrance, Los Angeles Co.	24- 4-14	3,502	O.S. cmtd.
Monarch Oil Corp., No. 1 Topanga, Los Angeles Co.	5- 1-16	....	rigging up
Frontier Oil Co., No. 1 Pico, Los Angeles Co.	7- 2-11	2,871	sd. sh. drlg.
Shively, N. O., No. 1 Puente Hills, Los Angeles Co.	23- 2-10	3,185	wet
Pressel & Tuil, No. 1 Puente Hills, Los Angeles Co.	30- 2- 9	4,200	suspended
International Dev. Co., No. 1 Saugus, Los Angeles Co.	34- 5-16	4,335	P.B. 4,060
Republic Pet. Co., No. 1 Newhall, Los Angeles Co.	6- 3-15	1,812	P.B. 1,085
Nuoil Co., No. 1 Newport, Orange Co.	29- 6-10	6,485	suspended
Shannon, C. G., No. 1 Yorba Linda, Orange Co.	21- 3- 9	5,777	P.B. 2,800
Great American Pet. Co., No. 2 East Coyote, Orange Co.	19- 3- 9	3,366	cleaning out
Bartholomae Oil Co., No. 2 East Coyote, Orange Co.	22- 3-10	1,014	sd. sh. drlg.
San Diego Pet. Co., No. 1 Chula Vista, San Diego Co.	32-18- 2	6,344	run tubing
Stephens, J. T., No. 1 Chula Vista, San Diego Co.	27-18- 2	1,394	hd. sd. drlg.
Edmonds, E. A., No. 1 Trustee, San Diego Co.	29-15- 3	2,431	hd. sd. drlg.

drilling due to aggressive drilling operations of the Honolulu Consolidated Oil Corp. and the Union Oil Co. In the Midway-Sunset Field the Honolulu is drilling three wells and has started preparations to start five new wells. Most of the Honolulu's new drilling is centered in Section 14-32-24 and may be attributed to the fact that the Standard is engaged in normal development in Section 15-32-24. During the current week the Standard added a new well to its list of producers in Section 15-32-24 when No. 29-15-D was brought in flowing 384 bbls. of clean 29.3 gravity oil and 480,000 feet of gas per day from 2,688 feet after the hole had been finished with a 7-inch liner carrying 110 feet of perforated.

Mount Poso

The Union Oil Co.'s drilling operations in the San Joaquin Valley is featured by the number of new wells projected to be drilled in the Mount Poso Field of Kern County. During the early part of the current week the Union completed No. 19 S. & M., brought in pumping 1,176 bbls. of clean 16.9 gravity oil per day from 1,745 feet. No. 20 S. & M., which was spudded in March 12, has been cemented and should be tanking oil within the next week. Wells in this field are drilled with great rapidity. The Union is grading locations for eight new wells in the Mount Poso Field and drilling operations will be advanced with consistency. The Shell is making preparations to start two new wells on the Vedder and Redder-Rall leases and will expand the scope of work during the next several weeks. The Shell has just completed No. 17 Vedder pumping 590 bbls. per day from 1,940 feet after the hole had been finished with a 6⅝-inch liner including 101 feet of perforated, and No. 19 Vedder looks good for at least 500 bbls. per day from 1,925 feet. No. 18 Vedder, finished during the early part of the week, was brought in pump-

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S. T. R.	Depth	Status—
General Pet. Co., No. 14 Capitan, Santa Barbara Co.	32- 5-30	....	rig, suspended
Shell Oil Co., No. 4 Capitan, Santa Barbara Co.	5- 4-30	1,675	sd. sh. drlg.
Fairview Oil Co., No. 1 Purisima, Santa Barbara Co.	18- 7-34	2,980	fishing
Advance Pet. Co., No. 1 Naples, Santa Barbara Co.	7- 4-29	5,891	hd. sh. drlg.
Barnsdall-Rio Grande, No. 10-88 Elwood, Santa Barbara.	tideland	3,125	hd. sh. drlg.
Barnsdall-Rio Grande, No. 2 Elwood, Santa Barbara Co..	15- 4-29	3,490	recmtd. 3,297
East Elwood Pet. Co., No. 1 Elwood, Santa Barbara Co...	14- 4-29	3,767	wet, idle
Shell Oil Co., No. 1 Goleta, Santa Barbara Co.	20- 4-28	6,508	wet
West Elwood Oil Co., No. 1 Goleta, Santa Barbara Co. ..	9- 4-28	2,992	hd. sh. drlg.
General Pet. Co., No. 4 Rincon, Ventura Co.	tideland	2,900	hd. sd. drlg.
Las Posas Pet., No. 1 Las Posas, Ventura Co.	22- 3-20	7,998	sd. sh. drlg.
Oil Ridge Oil Co., No. 1 Ventura, Ventura Co.	1- 4-19	1,573	fishing
El Rancho Oil Co., No. 1 South Mountain, Ventura Co. ..	9- 3-19	401	sd. sh. drlg.
The Texas Co., No. 128 South Mountain, Ventura Co.	4- 3-19	5,882	sd. sh. drlg.
Bolsa Chica Oil Co., No. 2 Piru, Ventura Co.	4- 4-18	950	sd. sh. drlg.
Continental Oil Co., No. 1 Ojai, Ventura Co.	12- 4-23	1,860	hd. sd. drlg.
Prop. Service Corp., No. 1 Lloyd, Ventura Co.	24- 3-23	7,110	swabbing
Continental Oil Co., No. 4 San Miguelito, Ventura Co. ...	23- 3-24	....	grading
Standard Oil Co., No. 1 Lost Hills, Kern Co.	2-26-20	2,861	br. sh. drlg.
General Pet., No. 1 South Belridge, Kern Co.	30-28-21	11,377	mill at 9,516
Standard Oil Co., No. 1-A North Belridge, Kern Co.	36-27-20	8,320	hd. sd. drlg.
Standard Oil Co., No. 2 North Belridge, Kern Co.	36-27-20	5,671	suspended
Belridge Oil Co., No. 32-35, North Belridge, Kern Co. ...	35-27-20	....	rig, deep test
Standard Oil Co., No. 1 Delano, Kern Co.	1-25-23	2,455	gas, shut in
Standard Oil Co., No. 2 Delano, Kern Co.	1-25-23	....	bldg. rig
Trico Oil & Gas Co., No. 1 Alpaugh, Kern Co.	3-25-23	2,525	gas well
Trico Oil & Gas Co., No. 3 Alpaugh, Kings Co.	36-24-22	2,750	sd. sh. drlg.
Trico Oil & Gas Co., No. 4 Alpaugh, Kern Co.	3-25-23	....	bldg. rig
Signal Oil & Gas Co., No. 1 McVan, Kern Co.	10-27-27	....	grade
Macmillan Pet. Co., No. 1 McVan, Kern Co.	2-27-27	....	rig, suspended
Golden Bear Oil Co., No. 1 Kern Front, Kern Co.	32-27-27	2,732	suspended
Hancock Oil Co., No. 5 Mountain View, Kern Co.	14-30-28	4,450	sd. sh. drlg.
Associated Oil Co., No. 1 Mountain View, Kern Co.	3-31-29	5,501	suspended
Shell Oil Co., No. 1 Mountain View, Kern Co.	32-30-29	4,251	sd. sh. drlg.
C. C. M. Oil Co., No. 1 Mountain View, Kern Co.	11-30-28	....	bldg. rig
Union Oil Co., No. 5 Mountain View, Kern Co.	15-30-28	5,474	redrlg. 4,131
Union Oil Co., No. 6 Mountain View, Kern Co.	9-30-28	6,600	sd. sh. drlg.
General Petroleum, No. 3 Mountain View, Kern Co.	14-30-28	5,391	sd. sh. drlg.
The Texas Co., No. 4 Mountain View, Kern Co.	14-30-28	5,526	cmtd. 5,206
The Texas Co., No. 5 Mountain View, Kern Co.	14-30-28	5,391	sd. sh. drlg.
Barnsdall, No. 3 Mountain View Deep, Kern Co.	31-30-29	8,093	sd. sh. drlg.
Hogan Pet., No. 6 Mountain View, Kern Co.	4-31-29	5,900	sd. sh. drlg.
Hogan Pet., No. 7 Mountain View, Kern Co.	29-30-29	4,002	sd. sh. drlg.
Jergins Trust, No. 5 Mountain View, Kern Co.	24-30-28	3,291	sd. sh. drlg.
Standard Oil Co., No. 5 Mountain View, Kern Co.	24-30-28	5,440	O.S. drlg.
Standard Oil Co., No. 6 Mountain View, Kern Co.	23-30-28	5,398	O.S. drlg.
Hoyt, Otis, No. 2 Mountain View, Kern Co.	24-30-28	5,755	P.B. 5,591
Ohio Oil Co., No. 1 Mountain View, Kern Co.	33-30-29	5,999	P.B. 5,736, idle
Mountain View Oil Co., No. 1 Mountain View, Kern Co. ..	25-30-28	5,501	sd. sh. drlg.
Gilmore Oil Co., No. 1 Edison, Kern Co.	23-30-29	956	sd. sh. drlg.
Jergins Trust, No. 5 Edison, Kern Co.	14-30-29	1,462	O.S. drlg.
Jergins Trust, No. 6 Edison, Kern Co.	13-30-29	2,154	sd. sh. drlg.
Jergins Trust, No. 7 Edison, Kern Co.	14-30-29	1,580	sd. sh. drlg.
Consd. Crude Oil Co., No. 1 Edison, Kern Co.	17-30-29	5,508	test W.S.O.
Shell Oil Co., No. 4 Edison, Kern Co.	15-30-29	3,776	cleaning out
Shell Oil Co., No. 5 Edison, Kern Co.	21-30-29	3,303	cleaning out
Shell Oil Co., No. 6 Edison, Kern Co.	14-30-29	1,870	O.S. drlg.
Monterey Expl. Co., No. 7 Edison, Kern Co.	15-30-29	3,268	P.B. 3,170, idle
Chaulk Oil Co., No. 1 Edison, Kern Co.	5-30-29	1,992	sd. sh. drlg.
H. & B. Oil Co., No. 1 Edison, Kern Co.	6-30-30	980	sd. sh. drlg.
Seeple Oil Co., No. 1 Edison, Kern Co.	4-30-29	....	rig, suspended
The Texas Co., No. 1 Edison, Kern Co.	4-30-29	3,517	pump 211 b.d.
Mohawk Oil Co., No. 1 Edison, Kern Co.	3-30-29	331	sd. drlg.
Foster, Inc., No. 1 Edison, Kern Co.	8-30-29	5,003	suspended
Berry Oil Co., No. 1 Edison, Kern Co.	25-30-29	973	sd. sh. drlg.
General Pet., No. 3 Edison, Kern Co.	24-30-29	1,678	pump 128 b.d.
General Pet., No. 4 Edison, Kern Co.	14-30-29	1,030	sd. sh. drlg.
Petroleum Drilling Co., No. 1 Edison, Kern Co.	22-29-29	1,010	sd. sh. drlg.
Signal Oil & Gas Co., No. 1 Edison, Kern Co.	31-29-30	2,258	suspended
Signal Oil & Gas Co., No. 2 Edison, Kern Co.	5-30-30	....	material
Signal Oil & Gas Co., No. 3 Edison, Kern Co.	36-29-29	193	suspended
General Pet., No. 1 Arvin, Kern Co.	1-32-29	....	location
Hall-Baker Co., No. 1 Arvin, Kern Co.	16-31-30	1,276	cmtd. 1,102
Sea Cliff Oil Co., No. 1 Greenfield, Kern Co.	7-31-28	3,760	sd. sh. drlg.
Standard Oil Co., No. 1 Semi-Tropic, Kern Co.	8-27-23	3,200	gas, shut in
Seeple, J. O., No. 1 Elk Hills, Kern Co.	5-30-24	3,731	suspended
Richfield Oil Co., No. 2 Devil's Den, Kern Co.	14-25-18	2,501	rig to pump
The Texas Co., No. 1 Temblor, Kern Co.	29-29-21	4,430	gr. sh. drlg.
Shell Oil Co., No. 1 Buena Vista, Kern Co.	9-32-25	5,093	hd. sh. drlg.
Reserve Oil & Gas Co., No. 1 Tejon, Kern Co.	2-10-19	3,591	gr. sh. drlg.
Reserve Oil & Gas Co., No. 2 Tejon, Kern Co.	12-10-19	1,855	resume work
Badger Oil Co., No. 1 Tejon, Kern Co.	31-11-19	6,248	redrlg. 3,850
Russ Oil Synd., No. 1 Dos Palos, Fresno Co.	28-12-11	5,110	rebldg. rig
Standard Oil Co., No. 1 Coalinga, Fresno Co.	13-20-14	....	bldg. rig
Wellington Oil Co., No. 1 Coalinga, Fresno Co.	14-20-14	451	sd. sh. drlg.
Union Oil Co., No. 1 Lillis-Kettleman, Fresno Co.	24-21-16	10,944	redrlg. 6,992
K.N.D.A., No. 56 Kettleman, Kings Co.	8-22-16	10,154	redrlg. 9,732
Standard, No. 2 Kettleman Middle, Kings Co.	29-23-19	3,987	sd. sh. drlg.
Continental Oil Co., No. 1 Kettleman-South, Kern Co. ...	7-25-20	3,571	cmtd. 3,532
Farrel Pet., well No. 1, San Luis Obispo Co.	18-31-12	1,432	sd. sh. drlg.
Willett Oil Co., No. 1 Cholame, San Luis Obispo Co.	10-25-15	3,660	cmtd.
Schuster, C. R., No. 1 Tulare, Tulare Co.	27-22-23	....	rig, suspended
Commonwealth Consd. Gas Co., No. 1 Tulare Lake, Kings	21-22-20	2,490	gas well
Commonwealth Consd. Gas Co., No. 2 Tulare Lake, Kings	21-22-20	....	rig, rained out
General Pet., No. 1 Devil's Den, Kings Co.	20-24-18	499	redrlg. 300
Buttes Oilfields Co., No. 2 Marysville, Sutter Co.	35-16- 1	7,013	to set pipe
Amerada Pet., No. 1 F.I.D., San Joaquin Co.	15- 2- 5	....	rigging up
Pure Oil Co., No. 1 Chowchilla, Madera Co.	7-10-14	8,402	P.B. 8,085, idle
Northern Counties Pet., No. 1 Tehama, Tehama Co.	25-24- 3	2,855	gr. sd. drlg.
The Texas Co., No. 1 Petrolia, Humboldt Co.	1- 3- 2	4,860	sd. sh. drlg.

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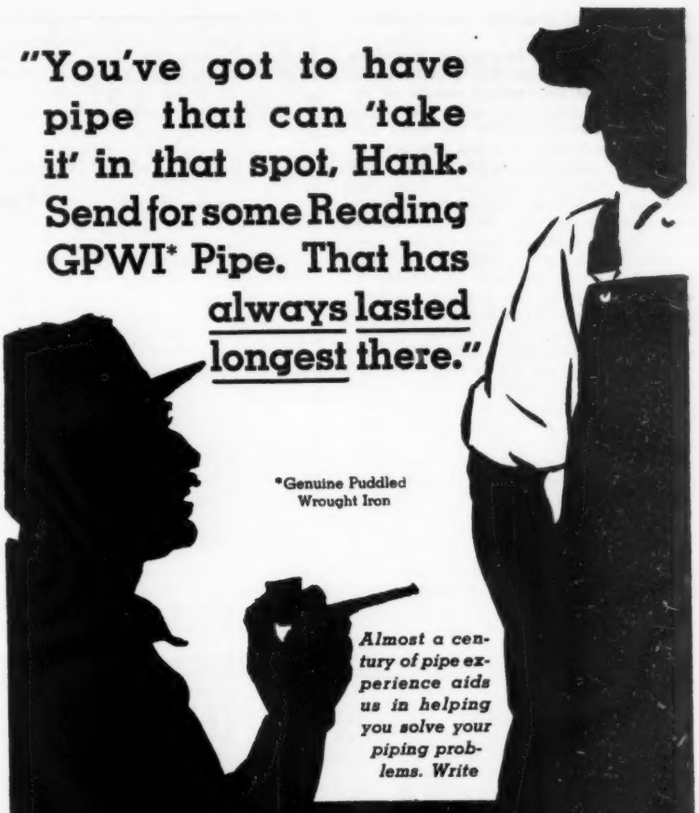

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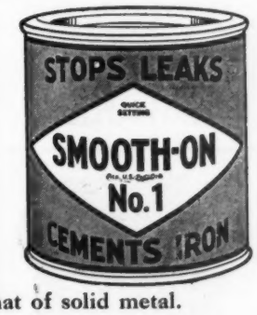

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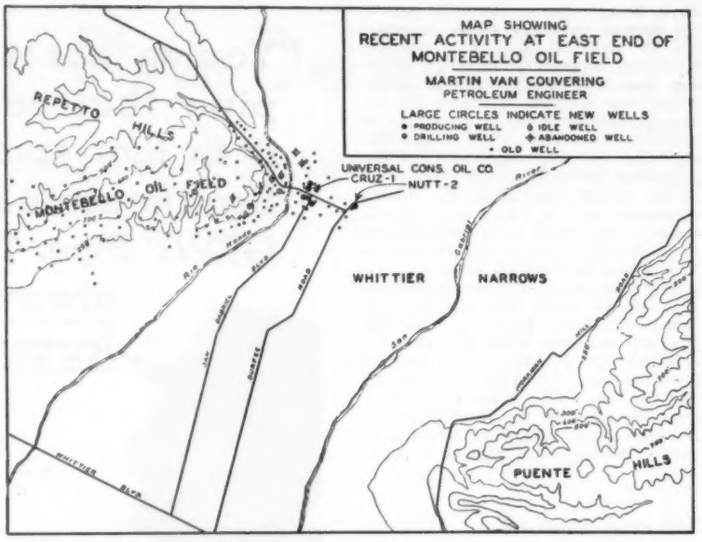
ing 620 bbls. of clean 16.4 gravity oil per day from 1,947 feet.

Up in the Devil's Den region, Richfield Oil Co. has finished No. 2 Alferitz, a new well, and this project should be on production within the next few days. The well is being put on the beam following completion at 2,501 feet and it should be good for approximately 150 bbls. per day. Two new wells were finished in the Edison Field of Kern County during the current week but both of them showed a rather large cut and may require further work. The General Petroleum led off the week by making a production test on No. 1 Knapp following completion at 1,678 feet but this new well was good for only 148 bbls. of 16.7 gravity oil cutting 41 per cent. This well was finished with a 6⅝-inch liner carrying 547 feet of perforated. The Texas Co.'s No. 4 Seal was also somewhat below expectations as it was good for only 211 bbls. of 17.1 gravity oil cutting 17.1 per cent upon completion at 3,517 feet after the hole had been plugged back from 3,517 feet.

Kettleman Hills

The most important development in the North Dome of Kettleman Hills is the annual readjustment of proven acreage which always takes place after the first of February of each year.



When the Kettleman North Dome Association was formed, the limits of the field were set out by two different colored lines. The red, or inner line, defined the minimum amount of acreage that could participate in production of the field. This could not be challenged because it was the basic foundation agreed upon by all interested parties. After the red line was established the engineers committee established an outer or blue line which was believed to enclose the maximum amount of possibly productive acreage. Then came the purple line which took up the slack between the red and blue lines and now we have an orange line which takes up the slack between all previous lines. Preliminary reports indicate that the participating and nonparticipating acreage in the North Dome of Kettleman Hills will show a substantial change this year. Directors of the Kettleman North Dome Association will meet within the next few days to ratify findings of the engineering committee and, if no change is made, an additional 280 acres will be added to the productive limits. Productive acreage in the northern part of the field will be substantially increased but participating acreage in other sections of the field will be reduced.

New Wells

Two new wells were finished in the North Dome of Kettleman Hills during the early part of the current week and both stand to the credit of the Standard Oil Co. The company's No. 36-27-J, bottomed at 7,825 feet but plugged back to 7,753 feet, was brought in doing 126 bbls. of clean 37.7 gravity oil and 1,700,000 feet of gas per day. This is the smallest well to be finished in the North Dome of Kettleman Hills in a long time. The other well listed as completed this week was really completed in February although it did not establish its potential until it was given a test this week. This well, No. 38-21-J, established a potential daily production of 967 bbls. of clean 37.6 gravity oil and 1,968,000 feet of gas per day from 8,230 feet.

Two new wells were finished up in the Santa Barbara Mesa Field this week, but only one of them showed commercial production. This was the Rio Grande Oil Co.'s No. 7 Perkins, which was bottomed at 2,001 feet and finished with a 6⅝-inch water string landed and cemented at 1,961 feet. This well was brought in flowing 748 bbls. of clean 18.1 gravity oil per day. The B. G. M. Oil Co.'s No. 1 Barbo was bottomed at 2,000 feet but failed to show substantial production when put on the beam as it was good for only 71 bbls. of clean 17.2 gravity oil per day. The San Diego Petroleum Co. focussed the attention of operators on the southern part of the state this week by getting a good showing of gas in its test which is being drilled in Tia Juana River bed. This well proved to be the mecca for the citizens of San Diego who have been consistently endeavoring to develop a commercial deposit of oil. It is needless to say that this community will show a tremendous jump if a commercial accumulation of either oil or gas is developed. The San Diego Oil & Gas Co.'s well, which caused so much excitement this week because of its blowout, failed to show enough oil to color the ditch. It is significant to note, however, that San Diego will be sitting on top of the world if a commercial deposit of natural gas is developed as this community's supply must come from Los Angeles Basin Fields or other districts located farther north.

PACIFIC COAST PROGRAM

Production research work, commercial aviation, and curtailment of oil production will be discussed by oil men attending the spring meeting of the Pacific Coast district of the American Petroleum Institute's Division of Production at Los Angeles, Calif., April 2. Oil men of California have been invited to attend the dinner to be served in the Jonathan Club.

The speakers will be. Pierson M. Hall, U. S. attorney for the Southern district of California, who will discuss "Enforcement of Curtailment"; Dr. William N. Lacey, of the California Institute of Technology, whose subject will be "Relation of Research to Production Problems," and H. W. Beck, Transcontinental & Western Air, Inc., who will talk on "Commercial Aviation and the Oil Industry."

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Sage Creek Test in British Columbia Has Small Showing of Gas and Deepening

By VICTOR LAURISTON
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Mar. 23.—In the Sage Creek area of southeastern British Columbia, Columbia Oils' No. 1 got a small show of gas at 2,393 feet and is deepening. At this depth the formation is considerably fractured. A previous gas show was met at 1,900 feet, and oil shows were reported at 100 feet, 1,125 feet and 1,370 feet. It is not far from Crow's Nest-Glacier Oil Co.'s No. 1 which has encouraging shows of light crude, approximating commercial production, around 3,265 feet, but had to be abandoned owing to drilling difficulties.

Turner Valley Field

In Section 28-18-2w5, South Turner Valley, Publix Oil & Gas Co.'s No. 1, LSD 8, is below 5,290 feet and more than 380 feet in the lime. Additional wet gas has increased the flow to around 6,000,000 feet a day. It logs closely with Freehold-Mar Jon's No. 1 and Becker Syndicate's No. 2 Anaconda, same section, both of which got the main porous horizon around 400 feet in the lime. British Dominion Oil & Development Corp.'s No. 4, LSD 6, is below 5,326 feet.

In the far south, Union-Freehold Oil Corp.'s No. 1, LSD 8, Section 21-18-2w5, passed through the brown sand of the Dalhousie at 5,422 feet. It contained some oil and gas, but proved to be tightly packed, and tested only about 2,000,000 feet of gas and from 8 to 10 bbls. of oil daily, not sufficient to justify a halt to take production. It is deepening below 5,528 feet with the Madison limestone expected around 5,650 feet.

Farther west North West Royalties' No. 1, LSD 5, is below 2,800 feet and got some good gas shows between 1,170 and 1,400 and additional gas at 2,390 feet.

In North Turner Valley, Royalite Oil Co.'s No. 26, LSD 5, Section 23-20-3w5, is in shale below 4,104 feet.

Tests in the Foothills

In the Alberta foothills outside Turner Valley, a number of tests will resume this spring. Winter drilling has been carried on in only three areas. One is the Highwood-Sinclair structure south of Turner Valley, where Canadian Royalties' No. 1 Banner, LSD 6, Section 34-17-3w5, is working on casing at 1,018 feet. It got a good show of gas in the McDougall-Segur sand at 905 feet, with considerable seepage of light crude, but has been held up by caving. Another active area is the Watson structure north of Lundbreck, Mar Jon-Maxmont's No. 4, LSD 10, Section 20-9-2w5, is unofficially reported around 1,800 feet and underreaming. Mar Jon Oil Co.'s No. 3, LSD 3, Section 4-10-2w5, is preparing to resume after cementing 18-inch casing at 740 feet. Raven Oils' No. 1, LSD 1, Section 20-9-2w5, cemented for water shutoff at 1,225 feet. Source Rock Petroleums' No. 1, LSD 13, Section 21-9-2w5, spudded several years ago and has outfit on location. Some winter work was also done on Paramount Oils' No. 1, LSD 2, Section 28-19-2w5, on the Rickert structure which has a fishing job at 3,553 feet. This is a fold west of the Turner Valley.

In the Monarch area, west of Olds, negotiations are being concluded for completion of Cartier-Majestic's No. 1, by Eastern Canada interests. It is in LSD 3, Section 36-31-10w5, and drilling will resume from 1,460 feet. Farther west, Hunter Valley Oil Co.'s No. 1 McLaren, LSD 12, Section 13-31-10w5, shut down last fall, and will resume from 4,814 feet, with prospects of an early completion. English interests headed by Campbell Hunter are backing it.

Northwest of Turner Valley, the Birch Ridge-Moose Mountain area is likely to see one or two tests active. On the Birch Ridge structure, Elbow Oils' No. 1, LSD 11, Section 35-22-5w5, has been standing at 4,375 feet. It is in the Dalhousie sand and a few hundred feet of drilling should be enough to test the Madison limestone. Farther south, F. D. Lundy and associates of Vancouver have an outfit in LSD 3, Section 6-22-4w5. Tentative arrangements have been made for completion as Prairie Royalties' No. 4. On the Moose Mountain structure, west and north, Graystone Petroleum Consolidated's No. 2 Signal Hill, LSD 9, Section 34-23-5w5, has been standing after redrilling to 1,710 feet. The original small hole, carried to 4,224 feet, got good oil shows between 3,907 and 4,167 feet. On the related Moose Dome structure, Moose Oils' No. 1, LSD 16, Section 29-22-6w5, which started in the Madison and got the Devonian lime at 550 feet, secured numerous shows of oil and gas but has been standing unfinished at 2,835 feet.

South of the Highwood-Sinclair structure, Pekisko Hills Co.'s No. 1, LSD 6, Section 6-17-2w5, on the Pekisko structure, will probably be deepened in the lime from 2,315 feet. It got the Madison high at 1,071 feet, and has still about 900 feet of lime to drill. Fair flows of dry gas were met at 1,480 and 2,025 feet, flows aggregating 4,000,000 feet being reported; with traces of light crude at 1,738 feet.

In Waterton Lakes Park, near the Montana boundary, Oil City Royalties' No. 1 was shut down last fall at 2,318 feet and will likely resume in the spring.

Alberta Border Fields

In the Alberta end of the international Red Coulee Field, Vanalta's No. 7, LSD 3, Section 4-1-16w4, is rigged ready to spud. O. R. Lang has the contract and standard tools are being used.

On the Del Bonita structure, Terminal Oil Co.'s No. 1, NE Section 18-1-21w4, is preparing to resume from 318 feet. Pat Adams is in charge, assisted by Fred Byron. S. M. Zandmer, geologist, of Los Angeles, is supervising the preparations. Sunshine Oils, Ltd., is reported arranging contract with O. R. Lang for its No. 1, on the Del Bonita structure in LSD 10, Section 19-1-21w4. Location is a little north of Terminal's No. 1.

On the Cardston structure, Franco Oils' No. 1, LSD 6, Section 5-2-25w4, is below 2,150 feet, after getting nine small gas shows and a couple of light crude seepages.

Farther east in the Alberta border area, two tests are expected to resume. In the Skiff Field, Devenish Petroleums' No. 5, LSD 4, Section 27-5-14w4, has been standing at 630 feet. The objective is a heavy crude horizon around 3,000 feet.

In southeastern Alberta, south of Medicine Hat, Comrey Oil Co.'s No. 1, Section 9-1-5w4, on the Comrey structure, has been standing since last fall at about 180 feet. D. A. MacDonald and associates of Vancouver are backing this test, which is being drilled on acreage of Imperial Oil, Ltd.

Vermilion Gas Test

In eastern Alberta, northeast of the Wainwright Field, Tenwell Gas & Oil Co.'s No. 1, R. R. Brennan farm, LSD 9, Section 36-50-7w4, on the Vermilion structure, spudded some weeks ago. The objective is a natural gas supply for Vermilion.

Lloydminster Gas Field

In western Saskatchewan, some new drilling is being undertaken this spring in the Lloydminster Gas Co., where Lloydminster Gas Co.'s No. 1 was completed a year ago, and has since last summer been supplying gas to Lloydminster. Lloydminster Gas Co.'s No. 2 has been located on the R. O. Gibb farm, 1 mile east of No. 1, Wilson and Mills handling the drilling. Lloydminster's No. 1 had an initial open flow of about 16,750,000 feet a day, with 565 pounds pressure, and if similar production is secured in No. 2, steps will be taken to pipe the gas to other communities in northern Saskatchewan, North Battleford and Saskatoon being the largest.

Colony Oil & Gas Co. has located its No. 1 in Section 25-49-27-w4, and is digging cellar. Location is somewhat east and south of Lloydminster's No. 1. The company was recently organized by Lloydminster interests, and is planning to drill three wells this season. Officers are: President, J. C. S. Fairbrother; vice president, W. A. Thorpe; secretary, Simcoe L. Daly; directors, Alex A. Miller, D. M. Philpotts, John Spencer, Murray A. Miller. John B. Messender will have charge of the drilling.

Drilling in Ontario

In the Dover Field, Kent County, Ontario, Central Pipe Line Co.'s No. 1 (formerly Medina Natural Gas Co.'s No. 2), Joseph Antaya farm, Lot 1, Concession 4, Dover East, is rigging up.

On the Alton farm, Bayham Township, Elgin County, E. P. Rowe's 1 and 2 are nearing completion in this sand.

In Bruce County, A. B. Holmes and associates of Toronto, drilling in Amabel Township near Hepworth, have secured some gas production in the Trenton limestone around 1,425 feet. It may be piped to Owen Sound, between 10 and 14 miles.

Gulf Coast Fields

(Continued from Page 147)

The test was spudded March 13, and on March 14, 13⅜-inch casing had been cemented at 1,235 feet. In one week's drilling time, the well was drilling in shale below 7,649 feet. The company is using its own rig. Since the field was discovered less than a year ago, 33 producers have been completed at depths from 7,850 to 8,900 feet, having a daily average of better than 17,000 bbls.

On the Crowley Prospect, in Acadia Parish, Humble Oil & Refining Co.'s No. 1 American Rice Milling Co., a deep test in Section 27-10s-1e, is reaming at 8,964 feet in shale.

George Strake's No. 1 Calcasieu National Bank, a deep wildcat test in Jefferson Davis Parish, has been plugged back to 7,918 feet and is preparing to test. The operators plugged back from 8,502 feet after an electrical coring test indicated a sand from 8,074-95 feet. The lower part of this body of sand was tested the past week and showed 310 feet of salt water.

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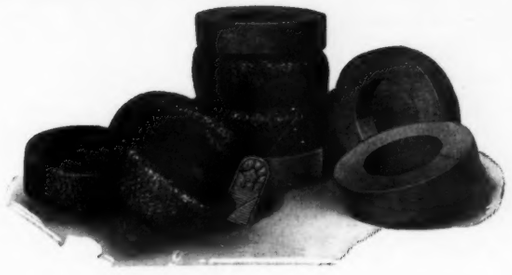

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Three New Locations Reported in Cooper Pool; Oil Show in Test South of Byron Field, Wyo.

By TOLBERT R. INGRAM
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Mar. 25. — Amerada Petroleum Corp.'s No. 1-D State, in the Monument area, Lea County, New Mexico, which opens a new pool, was plugged back 2 feet to shut off bottom water and made 25 bbls. an hour the first 10 hours and 29 bbls. an hour the next six hours. Continental Oil Co.'s No. 15-A-1 Vaughn, at the north edge of the Cooper Pool development, made 100 bbls. an hour with drill pipe in the hole. The Texas Co. made two locations and Phillips Petroleum Co. one location. Phillips Petroleum Co.'s No. 1 Worth, which connects the Jal and Cooper Pools, was completed for 600 bbls. a day. Atlantic Oil Co.'s No. 1-F State, a south edge well in the Eunice Pool, was plugged and abandoned. Ohio Oil Co.'s No. 2 State-McDonald, 5 miles southeast of the Eunice Pool, completed last fall as a gas well, was treated with acid and recompleted as an oil well, making 100 bbls. daily. Humble Oil & Refining Co. spotted one location in the Eunice Pool. Continental Oil Co.'s No. 3 Grimes is a new operation in the Hobbs Field. The Ryan Consolidated Petroleum Corp.'s No. 1 Acree, a wildcat in the Lea area, was plugged and abandoned and Henderson's No. 1 Russell-Steele is shut down for orders with salt water in the hole.

There were no completions or new locations in Colorado.

In Wyoming a show for a 30 to 40-bbl well of light gravity oil in a fault block south of the Bryon Field was reported by the Peay Oil Co. (Crosby & Huntington). The Argo Oil Co.'s O'Brien Springs test in Carbon County, was plugged and abandoned. Ohio Oil Co.'s No. 2 Rohlf, first well in Lance Creek to be drilled to the third Sundance, is estimated at 1,000 bbls. a day. The Texas Co. is resuming drilling operations in the Oregon Basin Field with one location. One new operation was reported in the Osage Field.

The Texas Co. is beginning its 1935 campaign in Montana with one location in Cut Bank and another in the Kevin-Sunburst Field. There were no completions in Montana.

NEW MEXICO

Monument Area—Lea County

Amerada Petroleum Corp.'s No. 1-D State, C NW NW Section 1-20-36, the discovery well in this area, which flowed 945 bbls. in 24 hours through the 3-inch at 3,929 feet, but which ran into bottom water when deepened to 3,954 feet, was plugged back to 3,946 feet. It then swabbed 244 bbls. in 10 hours and swabbed and flowed 174 bbls. in the next six hours, cutting 1 per cent basic sediment and 1 per cent water. The average per hour for the first 10 hours was 24.4 bbls. and for the next six hours, 29 bbls. an hour.

Cooper Area

One completion and three new locations were reported in the Cooper Pool. Continental Oil Co.'s No. 15-A-1 Vaughn, C SE 3E Section 15-24-36, was completed at 3,565 feet, total depth, from the pay at 3,500-63 feet and flowed 100 bbls. an hour through the casing with the drill pipe in the hole, along with 2,520,000 feet of gas. The 2½-inch tubing was then run to 3,555 feet. The elevation is 3,354 feet. This well and the Continental's Nos. 1-A and 2-A Vaughn in Section 14, both of which were completed recently as good producers, form a row of three wells in an east-west line across the north end of the pool, being the most northerly in the field.

Two new locations are the Texas Co.'s No. 1-B Ogg, C SE SE Section 34-24-36, and its No. 2-B Ogg, C SE NE Section 34-24-36. The first named is an offset to Phillips Petroleum Co.'s No. 1 Worth, C NE NE Section 3-25-35, reported a completion this week, and which is carried as a Jal Pool operation. The second location is an outside well on the west offsetting its No. 3-A Ogg, a producer. The third location is the Phillips Petroleum Co.'s No. 15 Woolworth, C SE NE Section 27-24-36.

Stanolind Oil & Gas Co.'s No. 4-A Meyers, C NE SW Section 22-24-36, is connecting up to complete at 3,620 feet. total depth. The former total depth was 3,608 feet. It was plugged back and tested at 3,560-75 feet, making 60 bbls. of fluid per hour, of which 25 bbls. was oil. It was then deepened to 3,620 feet where it will be completed. It is on the west edge in the northern part of the field, one location out from the nearest producer.

The Empire Gas & Fuel Co.'s No. 2 Everett, C SE SW Section 35-24-36, at the south end of the pool, was drilled to 3,490 feet in lime and flowed 500 bbls. of fluid, of which 85 per cent was water. It was then plugged back to 3,450 feet and is waiting on cement. The 7-inch is at 3,415 feet. Same company's No. 3 Everett, C NW SW Section 35-24-36, is drilling at 1,415 feet in salt, and its No. 4 Everett, C SW SW Section 35-24-36, has cellar and pits dug. Humble Oil & Refining Co.'s No. 2 Coats, W NW NE Section 10-24-36, is drilling at 2,691 feet in salt. Simms Oil Co.'s No. 1 Woolworth, C SE NE Section 35-24-36, is drilling by at 3,340 feet, 66 feet off old bottom. The Texas Co.'s No. 4 Ogg, C NW NW Section 35-24-36, cemented the 7-inch on bottom at 3,453 feet with 200 sacks and is waiting, and its No. 6 Ogg, C SW SE Section 35-24-36, is bottomed at 1,288 feet in anhydrite and trying to loosen stuck drill stem. Phillips Petroleum Co.'s No. 13 Woolworth, C SW NW Section 26-24-36, is waiting after cementing the 9⅝-inch at 1,365 feet with 350 sacks. It topped the anhydrite at 1,293 feet. Same company's No. 14 Woolworth, C NW SW Section 26-24-36, is drilling at 1,252 feet in anhydrite.

Jal Area

Phillips Petroleum Co.'s No. 1 Worth, C NE NE Section 3-25-36, which apparently connects up the Jal and Cooper Pools, was listed as a completion at 3,497 feet, total depth, from the pay at 3,478-97 feet. It flowed an average of 24.6 bbls. an hour for 16 hours through the 2½-inch tubing at 3,477 feet. The 7-inch is at 3,478 feet and the elevation is 3,262 feet.

Trinity Drilling Co.'s No. 1 Sholes, C NE NE Section 24-25-36, is drilling at 2,770 feet in lime, and the Texas Co.'s No. 1 Parker, C SW SW Section 29-26-37, is bottomed at 1,690 feet in anhydrite and waiting after cementing the 9⅝-inch at 1,643 feet with 1,000 sacks. Repollo Oil Co.'s No. 2 Gloyd, NW cor. SE Section 12-25-36, showed 500 feet of oil in 45 minutes in a drill stem test at 3,305-25 feet, the later being the total depth. It then cemented the 7-inch at 3,296 feet with 500 sacks. R. H. Henderson and others' No. 1 Langley, C SE SE Section 8-25-37, is drilling at 1,665 feet in anhydrite. Hammond, Inc.'s No. 1 Sholes, SE cor. NW Section 13-25-36, is waiting after cementing the 8¼-inch at 1,764 feet, and its No. 2 Sholes, NE cor. NW Section 13-25-36, is shut down at 145 feet. Southern Petroleum Exploration Co.'s No. 1-B Ascarate, C NE SW Section 24-25-36, began spudding March 5, set the 12½-inch at 125 feet with 185 sacks, and is drilling at 1,060 feet in red beds

Hobbs Area

One new location was reported in the Hobbs Pool in the Continental Oil Co.'s No. 3 Grimes, SW NW SE Section 28-18-38, on the east side, between Cusack's No. 1 Moon on the north and Continental's No. 1 Grimes on the south.

Shell Petroleum Corp.'s No. 2-D State, C NE NW Section 24-18-37, is drilling at 3,305 feet in lime and anhydrite, and its No. 1 Turner, SW cor. NE Section 34-18-38, is rigging up rotary. Noble and others' No. 1 Townsite, NW SE Section 34-18-38, is drilling at 3,880 feet in anhydrite, and Noble & Co.'s No. 3-C State, NE NW SW Section 24-18-37, is drilling at 3,425 feet in lime and anhydrite. The National Securities Oil Co.'s No. 1 Linam, NE SE SW Section 33-18-37, is drilling at 4,380 feet in lime.

Eunice Area

Atlantic Oil Co.'s No. 1-F State, C SW SW Section 29-21-36, at the southern edge of the developed area in the Eunice Field, was plugged and abandoned after shooting and acidizing in an effort to make it commercial. It was drilled to 3,976 feet last January and swabbed water. It was then plugged back to 3,968 feet, where it made 25 bbls. of oil and 5 bbls. of water in one hour after shooting and acidizing. Same company's No. 1-D State, C NW SE Section 20-21-36, which was staked last January, is an abandoned location.

One new operation was reported in Humble Oil & Refining Co.'s No. 3-B State, C NW NE Section 29-21-36, a location.

Ohio Oil Co.'s No. 2 State-McDonald, C NW SW Section 14-22-36, 5 miles to the southeast of the Eunice Pool and a mile to the east of No. 1 State-McDonald, a producer, has been recompleted after acidizing with 3,000 gallons and is flowing 100 bbls. daily of 36.8 degrees gravity oil. It was drilled to 4,350 feet last fall and was plugged back several times, finally being completed as a gas well last November from pay at 3,150-3,850 feet, making 27,000,000 feet of gas a day. The two wells are the only wells drilled within a radius of several miles.

Continental Oil Co. now has nine locations and drilling wells in the Eunice Pool. Those active are as follows: Its No. 18-A-2 Meyers, C NW SE Section 18-21-36, is running the 7⅝-inch at 1,628 feet, in anhydrite, and its No. 8-B-2 Meyers, C NE NW Section 8-21-36, is rigging up rotary. Its No. 20-C-3 State, C SE NW Section 20-21-36, is waiting at 1,628 feet, total depth, after cementing the 7⅝-inch at 1,625 feet with 150 sacks, and its No. 9-B-2 Meyers, C SE NW Section 9-21-36, is drilling at 2,615 feet in anhydrite and lime. Continental's No. 30-A-1 Lockhart, C SE NE Section 30-21-36, which has been testing for the past month at 3,959 feet, total depth, was flowing into the pits at last report, making 400 bbls. of oil plus 20 per cent water a day. Its No. 20-C-4 State, C SE SW Section 20-21-36, is rigging up rotary.

Tide Water Oil Co.'s No. 4 State-Foster, C NE NE Section 8-21-36, is fishing for bit at 1,139 feet in red beds. Shell Petroleum Corp.'s No. 1-A State, C SE NE Section 21-21-35, plugged back to 3,987 feet and swabbed 13 bbls. of oil and 120 bbls. of water in 16 hours and is shut down for orders. Old total depth was 4,404 feet. It is located on the west edge of the pool. Atlantic Oil Co.'s No. 1-C State, C SW SE Section 5-21-36, cemented the 7-inch on bottom at 3,771 feet with 800 sacks and is drilling plug. Repollo Oil Co.'s No. 1 Adkins, NW cor. SE Section 9-21-36, is bottomed at 3,870 feet in lime and is waiting after cementing the 7⅝-inch at 3,802 feet with 500 sacks. Skelly Oil Co.'s No. 2-B State, C SW NW Section 16-21-36, is running the 9⅝-inch at 1,660 feet in anhydrite. Gypsy Oil Co.'s No. 4 Bell-Ramsey, C NW NW Section 9-21-36, set the 10¾-inch at 368 feet with 150 sacks and is drilling at 1,226 feet in anhydrite, and Humble Oil & Refining Co.'s No. 2-B State, C SE NW Section 29-21-36, is drilling at 3,705 feet in lime.

Lea Area

Ryan Consolidated Petroleum Corp.'s No. 1 Acree, C NE NW Section 35-20-32, a wildcat 12 miles west and a little north of the Lea Pool, in a district where a number of tests have been drilled in recent years, was plugged and abandoned at 3,410 feet. It had 200 feet of sulphur water per hour at 3,405-10 feet. It was on acreage farmed out by Stanolind Oil & Gas Co. The elevation is 3,568 feet. The Texas Co.'s No. 1 Moore, C NW SE Section 21-30-32, located 2½ miles northwest of the Ryan Consolidated test, is shut down for orders at 3,019 feet, with sulphur water in the hole. Anderson & Pritchard's No. 1 Fisher, C SE NE Section 8-20-35, set the 12½-inch at 60 feet and is drilling at 605 feet in red beds. Argo Royalty Co.'s No. 1 Burner, SW NE NE Section 6-20-32, is fishing for bit at 2,810 feet in lime. It bottomed the salt at 2,455 feet and topped the brown lime at 2,505 feet.

Another apparent failure in this general area is R. H. Henderson and others' No. 1 Russell-Steele, C NE NW Section 24-20-33, which is shut down for orders at 3,464 feet in lime with 1,000 feet of salt water in the hole from 3,434-64 feet. It is 1½ miles west of the Empire's No. 1 Jewell & McDonald, which was completed in 1929 and is still making 60 bbls. a day.

The Texas Co.'s No. 1 Cole, C NE NE Section 35-19-33, is shut down for repairs at 1,117 feet.

Maljamar Area

Maljamar Oil & Gas Co.'s No. 1 Miller, C NW SW Section 23-17-32, is running the 12½-inch to bottom at 791 feet in anhydrite.

Nadine Area

Repollo Oil Co.'s No. 1 Arnold, SW NW SE Section 11-20-38, set the 15½-inch at 306 feet with 300 sacks, drilled to 1,264 feet in red beds and went back to 776 feet to straighten crooked hole.

San Simeon Area

Humble Oil & Refining Co.'s No. 1 Saunders, C NE NE Section 4-22-34, set the 9⅝-inch at 1,885 feet with 130 sacks and is drilling at 2,278 feet in salt.

Eddy County

Getty Oil Co.'s No. 7 Dooley, SW cor. NW Section 24-20-29, Getty Pool, which is to be a deep test drilled with rotary, is bottomed at 1,578 feet in lime and running the 13⅜-inch.

Roosevelt County

The Claudell Development Co.'s No. 1 Wilmes, C SW SE Section 21-2s-30, Pomeroy district, is bottomed at 3,628 feet in the Glorietta sand. It swabbed down

to 2,000 feet from the top, all water, and is testing.

San Juan County

Fred Mendenhall's No. 1 Burgen, NW cor. NE Section 21-29-11w, Aztec district, which drilled to 300 feet last fall, is reported abandoned at that depth. Lingenfelter's No. 1 Santa Fe, NE cor. NW Section 29-20-9w, had a hole full of water at 1,600-01 feet and is running the 8¼-inch. W. R. Webb's No. 1 fee, NE NW Section 6-30-11, is shut down for orders at 1,485 feet in shale. The Kutz Canon Oil & Gas Co.'s No. 1 Day, SW cor. Section 20-28-10, Kutz Canon district, is drilling at 4,290 feet in shale. H. C. Stratton's No. 1 Hart, SW NE SE Section 25-30-12, Aztec district, which had a bad fishing job at 1,680 feet, is shut down for orders. Continental Oil Co.'s No. 42, SW NE NW Section 12-29-19w, Rattlesnake Pool, is testing at 833 feet, total depth.

COLORADO

Archuleta County

The Oil City Petroleum Co.'s No. 1-A Garnett, NW NE SW Section 25-33-2e, Price district, is shut down at 1,098 feet on account of roads and weather and probably will not resume for a month. C. B. Garnett and W. M. Hackathorne were in Denver from the well this week with samples of cuttings which they are to have examined to determine the formation in which the test is bottomed. It had a good show of oil at 970 feet and the showings persisted to present depth, apparently coming from either a sandy lime or sandy shale. The oil stands 210 feet in the hole and more than 100 bbls. altogether have been bailed out. Hackathorne says he believes the formation is the Mancos shale and that the hole is close to the top of the Muddy.

Boulder County

Leslie R. Steele and others' No. 1 Maxwell, SW NE NW Section 24-1n-71, Boulder district, is bottomed at 340 feet and tools for which it has been fishing are coming out slowly.

Prowers County

Trojan Oil & Gas Co.'s No. 1 Lotus Oil, NW NE NE Section 15-23-46, Lamar district, is drilling out cement at 4,958 feet, total depth, after cementing, cave at 4,940 feet.

Adams County

Riddle Petroleum Co.'s No. 1 Baxter, C SW Section 2-3s-66, Derby district, is setting four 100-horsepower boilers. All equipment for this deep test is now on the ground and rigging up will be completed some time next week.

Moffat County

Stanolind Oil & Gas Co.'s No. 28-x Parkinson, NE SW SW Section 22-4n-92, Iles Dome, is spudding and will go to the Sundance.

Financial Report

The Kinney-Coastal Oil Co. in its annual report to stockholders says the company paid in full in 1935 the purchase price for the interest formerly held by Producers & Refiners Corp. on the Garland anticline in Big Horn and Park Counties, Wyoming, which completes the transaction whereby the company's operating interests in that field are increased to around 5,000 acres. Other companies have developed commercial production in the Madison lime on the structure and the Kinney-Coastal company planned to drill a test during 1934 on its acreage, but permission was withheld under the Government's conservation plan. Among nonproductive assets sold during 1934 was the pipe line from Bolton Creek to Casper, owned by the Bolton Oil Co., a subsidiary. The financial statement for the year ending December 31 shows current assets of $61,109 and current liabilities of $3,127, an excess of $57,982 in current assets over current liabilities.

WYOMING

Big Horn County

The Peay Oil Co. (formerly Crosby & Huntington) has a good show of light oil in its No. 1 Denio, Tract 43-C, Section 15-55-97, in a fault block at the southern end of the Byron structure. It has not been tested, but is estimated at 30 to 40 bbls. a day at 3,440 feet, total depth. It will be drilled a few feet deeper before completing. The location is about 2 miles south of some tests drilled in 1924 by the California Co., the best of which made 50 bbls. a day of light oil.

Ohio Oil Co.'s No. 2 Sidon Canal, SW cor. Lot 40, Section 24-56-97, is building road to location. Taylor Oil Co.'s No. 1 Hoskins, SE SE Section 25-26-97, is fishing for drill stem at 5,275 feet.

Yale Oil Corp.'s No. 1 Blakesley, NE NW Section 28-49-91, Bonanza district, is drilling at 1,160 feet, and the California Exploration Co.'s No. 1 Government, C SW SW Section 4-54-94, Spence district, is drilling at 478 feet.

Carbon County

Ohio Oil Co.'s No. 1 Kyle, NE SE NE Section 26-21-79, Medicine Bow district, joint with the California Co., is coring at 4,895 feet. It topped the Muddy at 4,840 feet and the core showed 10 feet of saturation. Ohio Oil Co.'s No. 1 Morris, C NW SE Section 6-20-77, Diamond Dome, is drilling at 7,210 feet in the red beds. It has cut 1,500 feet of red beds so far.

Argo Oil Co.'s No. 1 Johnson-Union Pacific, NE cor. SE Section 5-24-87, O'Brien Springs, failed to developed any production in the Muddy sand after plugging back from the Sundance and plugged and abandoned the test. The Sundance was at 3,491-3,506 feet and contained water. The Lakota, at 3,078-3,130 feet and the Dakota at 3,050-74 feet also contained water. The Muddy at 2,941-50 feet had a show of oil which was shot.

Earl W. Reeder, Inc.'s No. 1 Whitford, SW SE SE Section 24-20-64, Overland Dome, is bottomed at 3,595 feet and rolling out the 10-inch at 2,300 feet with rotary swedge. Ohio Oil Co.'s No. 10 Harrison & Cooper, NE NW SW Section 35-20-78, which is to be deepened as a test to the Sundance, is trying to pull liner at 2,734 feet.

Converse County

E. B. Jones and others' No. 1 State, SW cor. Section 16-32-69, Shawnee district, which is to be a deep test, has resumed after spudding to 22 feet last December. It set the 20-inch at 145 feet and is drilling at 150 feet. Same firm's No. 1 Jebel, C N half Section 17-32-69, which will go to the gas sand at 600 feet for fuel, is drilling.

Fremont County

Mid-American Oil Co.'s No. 2 Government, C NE SW Section 14-28-92, Sheep Creek, which made a discovery in the Embar that promises to open a new pool, cemented the 6⅝-inch at 2,175 feet. Bailing for eight hours failed to lower the fluid below 500 feet.

Hot Springs County

Argo Oil Co., principal operator in the Hamilton Dome Pool, purchased a lease on state land in the field last week at auction at Cheyenne for $50 an acre, or $6,000 for the tract consisting of the SW NW Section 14, NE NE Section 23, and NW NW Section 24-44-98. The company is planning some drilling in the field this year.

Natrona County

Bessemer Oil Co.'s No. 8 Government, SW cor. NW Section 18-33-82, Poison Spider district, was completed in the Sundance at 1,418 feet for an estimated initial of 40 bbls. a day. Rods and tubing are being run.

Niobrara County

Ohio Oil Co.'s No. 2 Rohlf, 100 feet south of C NE SE Section 32-36-65, Lance Creek Field, is being completed in the third Sundance sand at 3,901 feet and is estimated at 1,000 or more barrels daily. It is waiting after cementing the 7⅝-inch at 3,645 feet, on top of the Sundance formation. Drilling stopped in the top of the red beds. This is the first test to the third bench of the Sundance in Lance Creek. Two other wells have been drilled to the Sundance by the Ohio company, but both of these stopped in the upper bench. Its No. 4 Converse Sheep, SE SW SE Section 32, made 600 bbls. initial in 1930 at 3,731 feet, and its No. 2 Richards & Comstock, C NE SW Section 32, made 148 bbls. initial through tubing in 1932 at 3,650 feet. The three wells, located approximately half a mile apart, prove around 160 acres in the Sundance. Location has been made by the Ohio company for its No. 6 Lamb, SE cor. Section 32-36-65, and as soon as this well is drilled it will deepen its No. 2 Lamb, NE NW NE Section 5-35-65, from 2,952 feet to the Sundance.

Continental Oil Co.'s No. 1 Apex-3, SW NE SW Section 34-36-65, is drilling at 3,524 feet in hard sand and shells.

The S. & H. Development Co.'s No. 1-A Olinger, SE NE NW Section 1-36-63, Old Woman Creek, is drilling at 145 feet.

Park County

The Texas Co. released a location in the Oregon Basin Field this week in its No. 3 Sonners, E NE NW Section 29-51-100. The company has considerable production in the field which it treats in its refinery at Cody. This is the first well it has drilled in the field for some time. Rocky Mountain Gas Co.'s No. 1 Oregon Basin Oil & Gas, C SW NW Section 32-51-100, is waiting at a total

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depth of 1,330 feet after cementing the 8⅝-inch at 1,291 feet.

Garland Oil Co.'s No. 2 Government, SE NE NW Section 14-56-98, Garland Dome, erroneously reported abandoned recently, is fishing for string of new tools at 2,165 feet and expects the objective Peay sand at around 2,300 feet. If commercial production is not found in that horizon, the plan is to carry the test on down to the Madison. It is located in a fault block with commercial gas production in fault blocks to the north and south.

Washakie County

Wyoming Oil & Refining Co.'s No. 1 Frison, NW SW NW Section 14-48-91, Hidden Dome district, is drilling at 1,071 feet.

Weston County

The only active operation in the Osage Field is the Osage Trust Co.'s No. 26 State, C NE SE Section 14-46-64, which is rigged and ready to spud.

The Osage Oil Producers Association adopted a resolution at a meeting on March 11 petitioning the national oil administrator to recognize conditions in the field; that a representative of the Geological Survey be sent to lay before the association a statement of the Government's policy for the guidance of operators in the field and that the right to grant permits be restored to the Casper office as formerly to facilitate re-employment of drillers in the field. Approximately 9,000 of the 14,000 acres in the field, none of which are fully developed, are government leases and the operators are inclined to drill wells on their holdings the coming summer and relieve a serious shortage of work for drillers if conditions peculiar to the field are recognized by the Government.

MONTANA

Glacier County

The Texas Co., which was the most active company operating in the Cut Bank Field last year, is resuming drilling with the release of its first new location for the present season in its No. 6 Hinkle, NE cor. Section 2-34-6w. Fist and others' No. 1 Danen, Lot 10, Block 11, Section 12-33-6w, in the town of Cut Bank, which was reported a completion for 10 bbls. initial two weeks ago at 3,005 feet, total depth, was deepened to 3,160 feet. It encountered the Ellis-Madison contact at 3,150 feet and had sulphur water.

Askins' No. 1 Askins, Lot 24, Block 33, Section 12-33-6w, is drilling at 1,125 feet. Consolidated Gas Co.'s No. 3 Tribal, NE NW NW Section 34-35-6w, is drilling at 1,325 feet, and its No. 4 Tribal, NE SW NE Section 34-35-6w, is drilling at 2,430 feet. Gardner-Smith's No. 1 Tweedy, NE NE Section 36-33-6w, is rigging up, and the Indian Oil Co.'s No. 2 Winkler, SW SW Section 23-35-6w, is rigging up to resume at 2,585 feet. Kately & Kaup's No. 1 Drumheller, Lot 1, Section 10-34-6w, is drilling at 1,325 feet, and the Olive Oil Co.'s No. 3 Winkler, NE NW Section 35-35-6w, is drilling at 2,700 feet. R. C. Tarrant's No. 1 Connolly, C NE SE Section 31-34-5w, is drilling at 2,440 feet. Par Oil Co.'s No. 4 Haines, E SE SE Section 2-34-6w, is rigging up after moving rig on location last fall and suspending until spring.

Fergus County

S. W. Pennock and others' No. 1 Nordheim, NW NE NE Section 6-21-18, Scharf district, is drilling at 535 feet, and the Button Butte Oil & Gas Co.'s No. 1 Woodward, SE cor. SW Section 20-14-24, Button Butte, is drilling at 3,100 feet. It is in the Devonian and unless something worth while is encountered shortly, it will plug back to an oil show at 2,752-3,006 feet and test.

Liberty County

John Wilde's No. 2-A Mahoney, SE SW Section 23-37-4e, Whitlash district, is drilling at 400 feet, and J. H. Hamilton and others' No. 1 Northern Farms, C NE SW Section 10-37-5e, Flat Coulee, is shut down at 2,100 (cor.) feet.

Pondera County

Perry Withers' No. 1 Gjuillin, NW cor. SE Section 11-27-4w, Pondera Field, is drilling at 1,365 feet.

Toole County

The Texas Co. made a location in the Kevin-Sunburst Field for its No. 5 Swears, C SW Section 9-35-2w. This is the first drilling the company has undertaken in the field for several years. W. M. Fulton and others' No. 1 Halter, NE cor. SE Section 17-35-2w, is drilling at 1,664 feet. The Sunburst sand at 1,373-83 feet was dry and no sand was encountered at the Ellis-Madison contact at 1,598 feet. Monopeg Oils, Ltd.'s No. 3 Dipple, SW SW Section 28-35-1w, is drilling at 945 feet.

Another first report in the Kevin-Sunburst Field is E. O. Reickhoff's No. 2 Government, SW cor. NE Section 3-35-3w, a location.

Dr. B. A. S. Aronow, an independent operator in the Kevin-Sunburst Field, and who operates two refineries at Kalispel and Havre, has begun the construction of a 5-mile pipe line from his producers in the west end of the field to loading racks on the Great Northern Railroad just north of Kevin. An 11,000-bbl. tank is being erected on the Sohn farm at this location. The line will consist of 3-inch pipe for the main line and 2-inch pipe for the gathering system. This is the first gathering system constructed in this part of the field, the oil heretofore being trucked out.

Kansas Fields

(Continued from Page 149)

Hunton lime, logging same from 3,588-3,606 feet, total depth, getting 1,113 bbls. of oil on its initial gauge after acid treatment.

In the south end of the Burrton-Haury Pool, Olson Drilling Co. and Sinclair Prairie Oil & Gas Co.'s No. 3 Adkins, C NE SW Section 35-23-4w, failed to produce in terms of thousands of barrels, but this well stopped in Chat formation at 3,371 feet, total depth, flowing 50 bbls. of oil and 11,500,000 feet of gas on its completed gauge.

Eight new operations were started in Reno County during the week, all of which were in the Burrton-Haury Pool. They were: Barnsdall Oil Co.'s No. 2 Sabin-"A," NE SE NW Section 11-23-4w, rig; same company's No. 9 Sabin-"B," NW SW NE Section 11-23-4w, cellar; Olson Drilling Co. and Shell Petroleum Corp.'s No. 5 Goering-"A," NE SW Section 26-23-4w, rigging up; Olson and Continental Oil Co.'s No. 5 Krehbiel-"A," SE NW Section 26-23-4w, location; Olson, Shell and Continental's No. 3 Vogt, SW NE Section 26-23-4w, cellar; Gypsy Oil Co.'s No. 6 Krehbiel, C W half W half NE Section 35-23-4w, location; Olson and Shell's No. 5 Goering-"B," C E half E half NW Section 35-23-4w, location, and Gypsy Oil Co.'s No. 2 Myers, C NE NW Section 3-24-4w, cellar.

Sedgwick County

The Schulte Pool of Sedgwick County received another setback when D. Lauck and Shore Line Oil Co.'s No. 2 Jordan, SE SW SE Section 6-28-1w, found the Chat formation with only a small show of oil and gas, water in both the Simpson and Siliceous lime formation. It was dry and abandoned in Siliceous lime at 3,767 feet, total depth.

In the Robbins Pool, 3 miles south of Wichita, in McPherson County, E. B. Shawver's No. 4 Brookings, SE SW SW Section 16-28-1e, was completed for 213 bbls. of oil first 24 hours, production coming from Chat topped at 3,089 feet, first oil at 3,109 feet and total depth 3,116 feet.

Dickey Oil Co.'s No. 3 Brown, SW NE Section 20-28-1e, Robbins Pool, flowed 882 bbls. of oil on its completed gauge. Producing horizon is the Chat topped at 3,080 feet; pay was from 3,083-3,121 feet, total depth. It had been acidized with 1,000 gallons. In the same pool of Sedgwick County, Dickey Oil Co.'s No. 1 Cook, NE NW Section 20-28-1e, which was given up as a dry hole in January this year, stopping at 3,121 feet in Chat formation, was acidized with 1,000 gallons and it pumped 191 bbls. of oil first 24 hours.

Sedgwick County drew only one new operation during the week. It was Magnolia Petroleum Co.'s No. 7 Robbins, NE NW SE Section 20-28-1e, building rig.

Chase, Butler and Cowley Counties

In southeastern Chase County, Selby Oil and others had completed their No. 2 Leedy, NE NW SW Section 25-22-9e, in sand 2,433-59 feet, total depth, for 50 bbls. oil on swab after a 40-quart shot of nitroglycerin.

In the Augusta district of Butler County, Magnolia Petroleum Co.'s No. 9 Anderson, SW NW NW Section 15-27-4e, was a dry hole in the Kansas City lime drilled from 2,003-75 feet, total depth. At 2,046 feet, a show of oil prompted acid treatment and the well pumped 64 bbls. of oil and 29 bbls. of water in four days. A hole full of water was encountered at its base and it was abandoned.

In the Udall-Rock district of Cowley County, Trees Oil Co. completed its No. 1 Tittsworth, C NW NE Section 30-30-4e, for 35 bbls. of oil on the pump in sand 2,850-64 feet, total depth.

Cowley County drew two new locations in the staking of Trees Oil Co.'s No. 1 Houser, C SW SE Section 19-30-4e, location, and Lewis Production Co. and Gypsy Oil Co.'s No. 3 Pierce, SE NE SE Section 30-31-6e, location.

Greenwood, Sumner and Woodson Counties

Ward McGinnis' No. 1-A Prather, NW cor. Section 30-22-10e, Greenwood County, was rigging up; Henderson & Holden's No. 6 Harlan, C N half SW NW Section 34-22-11e, Greenwood County, was spudding; Shull Drilling Co.'s No. 5 Allis (a twin well), SW SE NW Section 17-24-13e, was a machine.

In the Wellington Pool of Sumner County, location had been staked by E. B. Shawver and others for their No. 2 Neal, NE SE SE Section 29-31-1w.

A wildcat location had been staked and drilling under way in Kite and others' No. 1 Gorman, NE NW Section 18-25-14e, Woodson County. This test lies about 10 miles west of Yates Center and is almost 2 miles north of production.

Harvey and Marion Counties

Ponds had been dug for Selby Oil Co.'s No. 1 Sperling, SE cor. Section 14-22-2w, Harvey County. Location had been made for Harwood Oil Co.'s No. 5 Cowman, NE SE SW Section 11-17-4e, Marion County.

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TECHNICAL QUESTIONS ANSWERED

By Charles K. Francis, Ph. D., Technical Editor

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible.

Inquiries must be signed but only the given initials will be printed. The source of the question is considered to be confidential.

Questions requiring a discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered.

When the matter is of general interest the reply will be published within a reasonable time.

Cooling Natural Gas Produced Volatile Base for Motor Fuel

What was the process first used for the extraction of gasoline from natural gas? Is it not true that natural gasoline has been largely responsible for making possible the modern motor fuel?—H. G.

The principle upon which the natural gasoline industry was founded is that of simple condensation, or cooling. It was noticed, about 1904, that the cooling of the natural gas passing through the pipe line crossing under the Ohio River at Sistersville, West Virginia, caused a part of the gas to condense to a liquid, which collected in the depressed portions of the line. It had been previously noted that during the cold months of the winter season a volatile liquid would accumulate in the low spots of the gas lines. Frequently the quantity of liquid would be so large that it interferred with the delivery of the gas. Traps were set in the lines to correct this condition by withdrawing the liquid, which was thus called drip gasoline. At that time there was but little demand for the lighter and most volatile portions of petroleum, such as were skimmed off in the refineries, and since this drip gasoline was similar to, although more volatile than, the refinery gasoline, it was discarded as a worthless product. It was not until about 1910, when the growing automobile industry became important enough to create a real commercial demand for gasoline, that any thought was given to selling it on a large scale.

Gasoline had been of so little value for so many years that no attempt had been made at the refineries to improve the distillation and condensing equipment to make it possible to obtain the maximum yields of gasoline from any given crude oil; in fact, every effort was made in the refineries to lose the maximum quantity of this low-boiling product. Consequently, the first gasolines to be used as motor fuel were deficient in what is at this time generally recognized as most important, that is, volatility. It was a common experience to find on the market during the first years of the automobile, gasoline which would not begin to boil until after it was heated to 150° F. This product resulted in very difficult startings of the motor, with long and dangerous cranking, which we know now was because of the low volatility of the gasoline.

The refiner soon began to search for something that would add the required volatility to his gasoline. Every effort was made to improve the conditions in the refinery so that losses of volatile parts of the crude oil would be reduced. At this time the discovery of the effect of cooling natural gas was remembered, cooling coils were placed in natural gas lines to cause the condensation of a product which was rapidly increasing in value. It was known that pressure aided the liquefaction of a gas, so it was natural to supplement the cooling with compression. The next advance was to pass the gas through a suitable oil for the purpose of absorbing by solution the liquid substances mechanically carried in the natural gas, and then to remove them from the oil by distillation.

The industry grew very rapidly and is now producing approximately 10 per cent of all the gasoline marketed, the larger part of which is blended at the refineries with the refinery gasoline to be consumed for motor fuel. The natural gasoline manufacturer has improved the methods during the past 20 years and standardized the specifications for natural gasoline to eliminate the extremely volatile liquids that were entrained in such large quantities by the early methods as to cause loss while in transportation or storage, and to introduce difficulties when added to motor fuel gasoline at the refineries.

This very brief outline of the history of natural gasoline indicates what influence the product has had toward perfecting gasoline for motor fuel.

Solvent Processes Use Physical Principles To Make Better Oil

The purification or treating of oil is generally considered to be a chemical process. Is this true when speaking of the solvent methods for making luubricating oils? Is an oil made by a solvent process better than a well treated (chemically) oil?—F. S. W.

The several solvent methods now being used for the purification of lubricating oils are entirely within the field of physics in so far that there are no chemical reactions involved as where, for example, litharge or sulphuric acid is used, but the chemical properties of all substances used in these processes must be adapted to the conditions.

It is thought that the gums, or resins, are in many instances produced by the action of sulphuric acid, so the new methods do not permit the formation of so large quantities of gum, therefore, carbon, as when treating with acid. In fact, the solvents are selected because of their power to exclude gum and high carbon content so that there will be less carbon deposited in the automobile engine as a result of the decomposition of the oil under service conditions. The same is true about gum, which may cause sticking of piston rings or valves.

The solvent method for finishing a lubricating oil is unquestionably a great advance in the art. The oils formerly so difficult to bring to a satisfactory condition for use as lubricants in the industries are now being refined by solvent methods to a high state of purity. It is claimed that these modern methods make it possible to eliminate all hydrocarbon compounds except those of the paraffin group and thus produce a lubricating oil which is 100 per cent paraffins. Because of the stability of these oils, containing only traces of gum and showing very low carbon residues, it appears from extensive road tests that the solvent method oils will go 25 per cent farther than the old process oils.

Petroleum Ceresin New Product for Hardening Wax

Petroleum ceresin is mentioned as a catalyst for hardening wax. Can you tell me what this is and how is it used?—W. A. E.

Petroleum ceresin is a solid, high melting point material derived from petroleum. This product is frequently deposited from crude oil after long storage, or upon cooling. It is separated from the residues containing wax when the solvent extraction methods are used. It acts to raise the melting point of paraffin wax and influences crystal formation.

The Utilization of Paraffin Wax and Petroleum Ceresin was the subject of a paper read before the Institution of Petroleum Technologists, London, December 11, 1934, from which this extract has been made.

Perhaps the most interesting property of petroleum ceresins is their effect on the crystallinity of ordinary distillate paraffin waxes. It has been known for many years that certain mixtures of ozokerite ceresin with paraffin waxes are of a minutely crystalline nature. Petroleum ceresins, however, show a much greater activity in this respect.

In the case of the East Indian ceresin it has been found that the addition of 0.3 per cent is sufficient to render commercial paraffin wax almost microcrystalline. All the characteristics of the original wax which are due, directly or otherwise, to marked crystallinity are then much modified; a high-melting wax which is normally highly crystalline and crumbly assumes a compact, granular structure and shows no sign of its original fragility; mottling and mealiness in a wax which has been insufficiently deoiled are much reduced and do not appear at all unless the oil-content is exceptionally active.

It has been found repeatedly that candles made from paraffin wax to which 0.2-0.3 per cent petroleum ceresin has been added display increased resistance to bending. The relative improvement is not the same for all waxes of different origin and similar setting-point but the effect is in lal cases quite definite. It is not likely that so small an addition of the ceresin would have a stiffening action of the type shown by stearine or even by larger proportions of the same ceresin, but rather that the plastic properties of the wax are influenced, in part at least, by the crystal size and the consequent degree of compactness.

Pourpoint of Fuel Oils Related to Composition and Heat

Your discussion of pourpoint December 20, 1934, in reply to B. C. R. is of interest, but I do not understand what is meant by the suggestion that if the composition remains unaltered the pourpoint will be constant. Will you kindly explain this detail?—R. D. M.

Any substance of uniform composition will have fixed physical properties. The fact that some oils, especially the residual black oils, are liable to show a variation in pourpoint, when the determinations are made at different times, has been explained as due to the heat treatment the oil has received during the previous 24 hours. This means conditions of the wax content, not necessarily the wax itself but associated substances.

R. H. Moerbeek and A. C. VanBeest, discussing the pourpoint methods before the Institution of Petroleum Technologists, January 8, 1935,* reported the results of their experiments relating to composition and the pourpoint of oils. They found that above a certain temperature of pretreatment, apparently close to that of the A.S.T.M. temperature of pretreatment, the higher the temperature the lower the pourpoint. Asphaltenes gave both plus and minus results. A small percentage of precipitated asphaltenes added to an insensitive residual fuel oil changed it to sensitive. The opposite was found for a fuel oil that was temperature sensitive as to its pourpoint, by making it insensitive when asphaltenes were removed. Acid treatment and filtering through earth had a similar influence.

Quoting from the reference:

"The most plausible explanation of the above-mentioned action of the asphaltenes is that on cooling from a sufficiently high temperature they become concentrated on the surface of the crystals. This impedes the formation of large crystals (not of aggregates), but the chief result of this 'skin' of asphaltenes is that the paraffin-wax crystals retain much less oil, and cannot form a network of crystals so easily, which reduces the pourpoint. The asphaltenes, moreover, seem somewhat to retard the process of crystallization.

"There is an artifice by means of which one can remove the asphaltenes from the paraffin wax and thus rule out their effect on the pourpoint. This is by cooling from 100° C. to 0° C. and then heating to about 35° C. and again cooling. One thus, indeed, achieves the object in view; at 35° C. the main mass of the wax crystals has already dissolved, whilst the 'skins' of asphaltenes from which the paraffin wax has been largely or wholly eliminated are obviously left behind in a state in which they cannot be 'picked up' by the crystals separating out during the second cooling.

"Hence, this is a device by means of which one can make the pourpoint determination independent of the presence of asphaltenes; some manipulation of this kind was at one time suggested by the A.S.T.M. subcommittee, but was not included in A.S.T.M. D 97-33."

These facts suggest that changing composition, probably both chemical and physical, is responsible for pourpoint fluctuations.

*See The Oil and Gas Journal, March 7, 1935, p. 33.

FIELD PROBLEMS FROM READERS

Edited by Thomas F. Smiley

Formulas Involved in the Use of Parallel Lines Are Complex

Your answer to a recent question concerning the use of several parallel oil pipe lines of small size instead of one large line leads me to ask if you can tell me how engineers figure the problem of pipe diameter in substituting a single line for several parallel lines. It seems to me there must be several factors to consider, including that of viscosity. My understanding is that while new methods of pipe line construction have permitted use of big-diameter pipe, it is still a practice of some companies which already have these multiple lines to add new lines when they want to increase carrying capacity instead of substituting one big line.—N. T. A.

Complex formulas are involved in the solution of the problems referred to in your question, and they cannot be gone into here. W. G. Heltzel and C. M. Scott, of the Stanolind Pipe Line Co., worked out formulas, the accuracy of which is said to have been demonstrated in practice. For the following general discussion of the problems involved this department is indebted to Mr. Heltzel:

"The problem of calculating the length and diameter of an additional line for a multiple system to obtain a desired capacity or to calculate the new operating pressures and capacities with the addition of a line of a given length and diameter, becomes complex and impractical if one tries to follow the formulas for parallel lines found in many of the text books on hydraulics. It must be kept in mind also that this problem concerns the hydraulics of fluids which have a wide variance in viscosities and densities.

"To facilitate the solution and meet the complexity of a problem, it has been a common practice of the oil pipe line engineers to reduce a system of multiple lines to the equivalent length of a single line of a chosen diameter. To explain what is meant by equivalent length: It can be demonstrated that three 8-inch (7.981 inches inside diameter) parallel lines of a certain length are equivalent in friction loss or capacity to a single 12-inch line (12.0 inches inside diameter) of a length which is 1.022 times the length of the three parallel 8-inch lines. Similarly four 8-inch lines would have an equivalent length factor of 0.62, converting to a single 12-inch line. Two eights and a single 10-inch (10.02 inches inside diameter) converted as parallel lines to a 12-inch would have an equivalent length factor, 0.66. Likewise three 8-inch parallel lines would have an equivalent length factor 0.4352 when converted to a single 10-inch line.

"All of this means that if the same amount of oil passing through the parallel lines were put through the single line, the length of the single line of the conversion diameter to give the same operating conditions as in the parallel lines would be obtained by multiplying the length of the parallel lines between the pumping and delivery point by the conversion factor, usually known as the equivalent length.

"Some of the equivalent length factors which have been used assume that the coefficient of friction remains constant regardless of the diameter of the pipe, the velocity of the fluid or whether the flow is streamline or turbulent. This assumption is not correct and such equivalent factors cannot be used safely in designing loops for oil pipe line systems."

This department is conducted in order that men connected with the drilling, producing and transporting branches of the petroleum industry may obtain aid in solving problems that confront them in their work. Readers are invited to send questions freely. These questions will be placed in the hands of persons capable of answering them authoritatively, and the answers, based on the best available information, will be published.

Each question should give as much detail as possible, especially if it involves depths of sands, types of sands and operations on adjoining or nearby properties. The source of questions will be considered confidential, and only the initials of the sender will be published. Questions involving patented processes, intricate formulas or estimates of cost cannnot be answered. If an immediate answer is important, one will be given by mail when the writer requests it.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or improved old ones.

Danger of Fire and Explosion Is Lessened by Open Building

Instead of enclosed buildings of the ordinary kind I understand that natural gasoline manufacturers in some fields are using an open type of construction which reduces the danger of fire and explosion since it does not offer a chance for explosive gas to accumulate. Can you give me any information concerning such buildings, how they are constructed and what material is used?—E. F. S.

Natural gasoline manufacturers in California use the open type of construction for their absorption-compression plants, and there are a few such buildings in the Gulf Coast region. It is likely their use will increase, for the danger of explosions and fires which is present around refinery and natural gasoline plant buildings, where leaking gas might accumulate, are much reduced by them.

The Shell Petroleum Corp. last year rebuilt the compression plant of the gas recovery system in its Houston, Tex., refinery and it adopted the open type of housing. The original building, an all-enclosed one, had been damaged by an explosion.

In a building in which the sides are entirely open the sweep of air through it prevents accumulation of gas in the event of leaks and consequently the men can work around the engines and compressors with much less danger. Also the men have a lighter, cooler and better ventilated place to work than in a closed building depending on doors and windows for fresh air. The machinery is more accessible and heavy pieces can be moved in and out more easily.

Although of secondary importance compared to the other advantages, the cost of the open type building is somewhat less than that of the all-enclosed building due to the elimination of the side walls.

As constructed by Shell Petroleum Corp., the open type building provides virtually as much protection for the equipment from the elements as does the conventional type of plant buildings. Only in case of hard winds is there much likelihood of rain blowing through it and little harm would be done if it did.

The building is of all steel construction, consisting of the roof supported on a steel structure. Only the rear is covered. It is 96 feet long and approximately 40 feet wide with the eaves extending well out over the sides. Housed in it are three 180 horsepower and one 225 horsepower gas compressors. Occupying 18 feet of space at the front end is the pumping equipment, including one gas blower, two lean oil pumps and two charging pumps.

A metal fire wall separates the pump space from the compressors and should there be a fire or other trouble around the compressors the pumps would be readily accessible and could be cut off without endangering the men.

The open compressor building necessitated a special room for the operators, and safety was taken into consideration by having the operators in a separate building about 50 feet distant but in full view of the plant. The building is a one-room, glass enclosed steel structure, 13 feet long and 10 feet wide. From it the operators can watch while free from hazards.

Why Was It Called That?

BASCULE BRIDGE

"Bascule bridge" has a strange look, but to the engineer it is simply a draw-bridge. Visitors to the Century of Progress fair in 1933 and 1934 saw a series of these bridges spanning the Chicago River, the newest of them being the one at Michigan Avenue. The word "bascule," taken bodily from the French, really offers a strong hint of a characteristic of the draw-bridge, for it is derived from the French "bas," down, and "cul," bottom, and it means seesaw. "Bridge" comes from the Middle English "brig," "brygge" and "brigge," and it has close relatives in ancient Scandinavian tongues. It was recorded in 1556 that "Thys yere sank a parte of London brygge with two arches." A hundred years or so later when Samuel Pepys, English diarist, referred to a bridge he sometimes meant a floating landing-stage used at piers for ship passengers. The word is found used in this sense on ancient maps of London.

How Accident Prevention Work Is Carried on in Oil Industry

You published in your issue of February 7, 1935, an answer to a question signed G. N. D. concerning prevention of accidents in the oil industry. In it you said the American Petroleum Institute had a department of accident prevention, with a director. Please tell me briefly what kind of work this department carries on that is effective in reducing accidents throughout the industry.—F. E. R.

Standing committees are appointed each year in each of three divisions for prosecution of the Institute's Department of Accident Prevention work. These committees usually meet twice a year to review and recommend material for publication and to guide and assist the secretary of the committees in the work of the department.

The committees of the three divisions—production, refining, and marketing—function separately on specific problems pertaining to their respective departments. However, so many of the committee members are interested in the activities of all departments that the members of the three committees are kept informed on all projects and practically serve as a joint committee.

One of the major activities of the committees is the development of manuals covering the handling of certain work in the various departments so as to prevent accidents.

Accident-prevention manuals published since 1931 include "Cleaning Petroleum Storage Tanks," "Safe Driving of Automobiles," "Gas and Electric Cutting and Welding," "Organization for Accident Prevention," "Operation of Service Stations," "Precautions in Well Pulling," and "Precautions for Workers on Construction and Maintenance of Refinery Equipment."

About 40,000 copies of these manuals have been distributed. Some companies that do not use the manuals take advantage of the material and develop their own codes or manuals for the more intimate contact with employes.

This activity has placed safety engineers in an excellent position to provide information that helps the operating executives to get their assignments done without mishaps which cause injuries or damage to property. Many requests for these manuals are received from engineering colleges and public libraries.

The department serves as a clearing house for information on special problems. If data are not available on a specific question, the question is passed along to members of the committees, and a summary of the replies is prepared. Important or interesting facts are called to the attention of the committees. For example, a confidential circular on the contamination of kerosene by gasoline vapors caused a number of companies to make changes in their practices in delivering these products.

Accident-prevention information is an important item. A four-page mimeographed bulletin carrying brief accounts of accidents which have occurred, calling attention to situations which may cause accidents, and suggesting material for consideration by safety committees is distributed widely.

The department provides an annual summary of injuries in the petroleum industry, summary of industrial-injury costs, and review of fatal accidents in the industry.

MARKET RECORD OF OIL SECURITIES

Active Oil Stocks Listed on New York Stock Exchange

Compiled by Carl H. Pforzheimer Co., 25 Broad Street, New York City, Members New York Stock Exchange and New York Curb Exchange

1935 High	1935 Low	Week ended March 23 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Dividend rate	Payable or last paid	Dividends paid in 1934	1934 High	1934 Low	1933 High	1933 Low
57	48½	3,900	52⅞	50	51½	Amerada Corp.	774,875	N.P.	50cQ	1-31-35	$2.00	55⅝	39	47⅝	18½
25⅜	21⅜	4,200	22⅜	21½	22⅛	Atlantic Refining	2,673,834	$25	25cQ	3-15-35	1.00	35¼	21½	32½	12⅝
7	5⅞	10,000	6⅜	6	6¼	Barnsdall Corp. A	2,248,795	$5	....	5-11-31	....	10	5⅞	11	3
7	3⅜	44,300	6	4⅛	5⅞	Columbia Gas & Elec.	11,610,036	N.P.	....	5-15-34	‡ .25	19¾	6⅝	28⅛	9
8¾	6½	11,200	7⅛	6⅝	7⅛	Consolidated Oil Corp.	14,218,835	N.P.	14c	10-31-34	.42	14¼	7¼	15⅝	5
19⅛	15⅛	10,800	16	15⅛	15⅝	Continental Oil of Delaware	4,738,593	$5	12½c	4-30-35	.50	22¾	15¾	19⅝	4⅞
18⅞	11¾	1,900	14¼	12½	14¼	General Asphalt	387.149	$10	....	6-15-32	....	23½	12	27	4⅝
3⅜	1½	4,300	2⅝	2	2¼	Houston Oil (new)	1,098,618	$25	....	10-17-30	....	5⅝	2½	7⅜	1⅞
1⅞	⅜	100	⅞	⅞	⅞	Louisiana Oil Refining	1,302,158	N.P.	....	.....	....	3⅜	⅜	4	⅝
12⅞	9½	1,900	10⅜	9⅞	10¼	Mid-Continent Petroleum	1,857,912	$10	25c	11-15-34	.50	14⅜	9⅛	16	3¾
14⅝	9	1,200	10⅜	9¼	10⅛	National Supply of Delaware	382,591	$25	....	5-15-31	....	21⅛	10	28⅝	4
10⅞	9¼	5,100	10	9¼	9⅞	Ohio Oil Co.	6,563,107	N.P.	15c	12-15-34	.45	15⅞	8½	17⅝	4⅜
8¾	7	2,000	8⅜	7¼	8⅜	Pacific Western Oil	1,000,000	N.P.	40c	11-30-34	.40	9⅜	5½	9½	3
1⅜	⅝	No sales ..	..	..	..	Panhandle P. & R.	198,770	N.P.	....	.....	....	2½	⅝	4¼	⅜
16	13¾	12,200	15¾	14½	15⅝	Phillips Petroleum	4,154,687	N.P.	25c	3-1-35	1.00	20¾	13⅜	18¾	4¾
8¾	6½	2,800	7⅜	6¾	7⅜	Plymouth Oil Co.	1,014,082	$5	4% Stk.	12-22-34	75c & 4% Stk.	16¾	7¼	17⅝	6¾
7¾	5⅞	5,400	6¼	5⅞	6	Pure Oil	3,038,370	N.P.	....	9-1-30	....	14⅞	6⅛	15⅜	2½
32⅝	29½	400	30¼	29⅞	30¼	Royal Dutch N. Y. shares	432,224	$14	$1.85	7-31-34	1.35	39⅛	28⅝	39¾	17⅝
26⅞	20¾	1,000	23	21	23	Seaboard Oil of Delaware	1,204,460	N.P.	15cQ†	3-15-35	1.00	38⅝	20¾	43⅜	15
7⅞	5½	5,200	5⅞	5½	5⅞	Shell Union Oil	13,070,625	N.P.	....	6-30-30	....	11½	6	11⅝	4
78¾	64½	500	66½	63⅛	66½	Shell Union Oil pfd.	400,000	$100	....	7-1-31	....	89	57	61	28½
18¾	13½	9,800	17¼	13¾	16¾	Simms Petroleum	461,698	$10	50c	2-1-35	.55	17⅛	7¼	12⅝	4⅞
8	6½	500	7¾	7⅜	7⅜	Skelly Oil	1,008,514	$25	....	12-15-30	....	11½	6	9⅞	3
14⅞	11	23,000	13	12⅛	12¾	Socony-Vacuum	31,019,694	$25	15cQ	3-15-35	.60	19⅞	12½	17	6
32⅜	27¾	6,500	29¾	28¼	29½	Standard Oil of California	13,102,900	N.P.	25c	3-15-35	1.00	42⅞	26½	45	19½
25¼	23	14,100	23⅝	23¼	23½	Standard Oil (Indiana)	15,941,894	$25	25cQ	3-15-35	1.00	32¾	23¼	34	17
32	29⅞	No sales ..	..	..	..	Standard Oil of Kansas	200,000	$10	50cQ	10-31-34	2.00	41	26	39⅞	12¾
43½	35¾	14,600	38	35¾	37¾	Standard Oil of New Jersey	25,740,065	$25	50cSA†	‖3-15-35	1.25	50⅛	39¼	47½	22⅝
68½	60½	600	61⅝	60½	61⅝	Sun Oil	1,733,013	N.P.	25cQ	3-15-35	$1 & 9% Stk.	74¼	51½	59	35
21⅝	16½	6,000	18½	17	18⅛	Texas Corp.	9,486,417	$25	25cQ	4-1-35	1.00	29⅜	19⅝	30⅛	10¾
4¼	3¼	2,300	3⅝	3¼	3⅝	Texas Pacific Coal & Oil	880,703	$10	....	12-31-29	....	6½	2½	6½	1⅝
10	7⅝	3,900	8	7⅝	8	Tide Water Associated	5,618,672	N.P.	....	2-16-31	....	14⅜	8	11¾	3⅛
88½	84	300	87¾	86⅛	87¾	Tide Water Associated pfd.	666,524	$100	$2§	4-1-35	§8.50	87	64½	65¼	23½
16⅝	14¾	2,500	16⅛	15½	16⅛	Union Oil of California	4,386,070	$25	25cQ	2-9-35	1.00	20½	11½	23⅜	8½
26⅛	20⅞	1,700	23½	22⅞	23½	Union Tank Car Co.	1,200,000	N.P.	30cQ	3-1-35	1.20	25⅜	15⅝	22¾	10½
2⅝	1	500	1⅝	1½	1⅝	Wilcox Oil & Gas	424,839	$5	....	5-10-28	....	5¾	2	5½	2

*Ex-dividend. †Plus extras. ‡Payable in preferred stock. §On account of accumulated and current dividends. ‖Distribution 4/75 Mission Corp.

Active Oil Stocks Listed on New York Curb

Compiled by Carl H. Pforzheimer Co., 25 Broad Street, New York City, Members New York Stock Exchange and New York Curb Exchange

1935 High	1935 Low	Week ended March 23 Sales	High	Low	Close	Stocks—	Total shares outstanding	Par value	Dividend rate	Payable or last paid	Dividends paid in 1934	1934 High	1934 Low	1933 High	1933 Low
33	30½	100	32½	31½	32½	Buckeye Pipe Line Co.	200,000	$50	75cQ	3-15-35	$3.00	38	26	39¾	25
2⅜	1⅝	1,200	1⅞	1⅝	1⅞	Carib Syndicate	799,020	25c	....	.....	....	5½	1½	7¾	¼
157	140	50	138½	138½	138½	Chesebrough Mfg. Co.	120.000	$25	$1Q†	3-29-35	11.50	150	116	129	71
1½	¾	21,200	1	¾	1	Cities Service	37,804,394	N.P.	....	6-1-32	....	4¼	1¼	6¼	1½
1/16	¾	1,300	1/16	¾	1/16	Colon Oil	2,200,000	N.P.	....	.....	....	3¼	½	4	¼
⅞	⅜	400	7/16	7/16	7/16	Cosden Oil	399,687	$1	....	.....	....	3⅞	½	3⅞	1⅜
13¾	10	5,800	11	10⅛	10⅝	Creole Petroleum	6,974,356	$5	....	.....	....	14⅜	9⅝	12	4⅜
4⅞	4½	No sales ..	..	..	..	Darby Petroleum	509,696	$5	25c	1-25-35	.50	7½	4⅛	8	2⅛
1⅛	1/16	No sales ..	..	..	..	Derby Oil & Refining	263.162	N.P.	....	.....	....	2¼	1	2¾	⅞
38	34	No sales ..	..	..	..	Eureka Pipe Line	50,000	$50	$1Q	5-1-35	4.00	37	30	41¾	20
60⅞	50¼	1,700	52⅜	51	52⅜	Gulf Oil Corp.	4,538.101	$25	....	10-1-31	....	76¾	49¾	62	24
50¾	44	4,900	47	45½	46½	Humble Oil & Refining (new)	8,923.935	N.P.	25cQ	4-1-35	§1.25	496	33¼	105½	40
17⅛	15⅜	3,800	16¼	15¾	15⅞	Imperial Oil of Canada	26,857.152	N.P.	25cSA†‡	12-1-34	.92½	17⅞	12⅝	15⅞	6½
4½	3⅝	100	4	4	4	Indiana Pipe Line	300,000	$10	15cSA	5-15-35	.35	6⅞	3⅝	8	3⅛
31⅜	28	5,100	29⅝	28½	29⅝	International Petroleum	14,247,088	N.P.	56cSA†‡	12-1-34	2.28	33⅜	19⅜	23½	8⅞
6	4⅜	9,000	5⅞	5½	5⅞	Louisiana Land & Exp.	3,000,000	N.P.	....	.....	....	5	2⅛	2¼	1/16
4⅜	3⅝	No sales ..	..	..	..	Lion Oil Refining	270,000	N.P.	....	10-27-30	....	6	3⅜	9½	1¼
6¼	4½	1,900	5¼	4¾	5¼	Lone Star Gas	5,382,723	N.P.	15c	2-15-35	‖ .16	8⅜	4¼	11⅞	4¾
4⅝	4⅛	1,900	4¼	4⅛	4¼	Mountain Producers	1,682,182	$10	15cQ	4-1-35	.60	5½	4	6½	2½
14	11¾	1,600	14	13¼	13½	National Fuel Gas	3,810,183	N.P.	25cQ	4-15-35	1.00	18⅛	13⅛	20	10
8	6⅝	No sales ..	..	..	..	National Transit	509,000	$12.50	35cSA	12-15-34	.75	9½	7	10	5½
2⅝	2	700	2	2	2	New Bradford Oil	1,445,202	$5	10cSA	3-15-35	.20	2½	1¾	2⅛	½
2⅛	1⅜	No sales ..	..	..	..	New Mexico and Arizona	1,000,000	$1	....	.....	....	2¾	1	1⅞	½
3⅝	3¼	No sales ..	..	..	..	New York Transit	100,000	$5	15cSO	10-15-34	.30	4¾	3	4⅞	3
5⅝	5¼	200	5½	5½	5½	Northern Pipe Line	120,000	$10	25cSA	1-2-35	.50	7	4⅝	6⅛	4¼
2⅛	1½	1,100	1⅝	1½	1½	Pantepec Oil	1,608,700	N.P.	....	.....	....	2⅝	⅞	3⅜	⅛
1¼	1	300	1	1	1	Ryan Consolidated	296.931	N.P.	....	.....	....	3⅜	⅞	4¼	⅝
6¼	5⅝	500	5¾	5⅝	5⅝	Salt Creek Producers	1,496.859	$10	20cQ	2-1-35	.80	7⅞	5½	9¼	3½
23¾	21⅞	400	22⅛	21⅞	22	South Penn Oil	1,200.000	$25	30cQ	3-30-35	1.20	26½	17½	22⅛	11
4	3⅞	No sales ..	..	..	..	Southern Pipe Line	100.000	$10	15cSA	3-1-35	.25	5½	3½	6	2⅛
52¼	45¼	No sales ..	..	..	..	Southwest Penna. Pipe Lines	35.000	$50	$1Q	4-1-35	5.00	47	41	43	24½
21⅝	18	2,500	19½	18¾	19	Standard Oil of Kentucky	2,606,983	$10	25cQ†	3-15-35	1.50	18⅜	14⅝	19¼	8⅜
9	8¼	600	7¾	7¾	7¾	Standard Oil of Nebraska	190,822	$25	....	6-20-34	.50	16⅞	8¼	20½	11
16¼	12	150	13	13	13	Standard Oil of Ohio	753,740	$25	....	1-3-33	....	28½	12¼	41	15½
1¼	1	200	1⅛	1	1	Sunray Oil	1,610,810	$1	....	4-15-31	....	2	1/16	1½	¼
6⅞	5	1,000	5½	5⅛	5¼	Texon Oil & Land	936,028	N.P.	15cQ†	12-29-34	.90	11	4⅜	13¾	6¼

*Ex-dividend. †Plus extras. ‡Payable in Canadian funds. §Includes 50 cents on old $25 par value stock. ‖Payable in preferred stock.

Note—In comparing highs and lows for the several years in the two tables, it will be necessary to take into consideration cases where there have been stock split-ups.

NATURAL GAS DEVELOPMENTS

Texas House Committee Acts on Gas Legislation

AUSTIN, Tex., Mar. 25.—The house oil and gas committee junked both of two competing formulas for proration of Texas gas wells for ratable taking, conferred broad powers on the Railroad Commission to allocate the production, authorized the continued use of "sweet" or fuel gas for carbon black manufacture, and exempted entirely the Pledger Field of Brazoria County along with all other gas produced deeper than 6,000 feet. It then returned a unanimously favorable report to a substitute for Representative H. K. Stanfield's bill designed to stop the wastage of gas through popping it into the air after stripping for gasoline. The report closed six weeks' work of the committee and subgroups over efforts to secure a measure to stop the popping of gas, particularly in the Texas Panhandle Field.

Representative B. L. Rogers of Ochiltree opposed the amendment to permit sweet gas to be used for carbon black manufacture.

Representative Hollis Frazer sponsored a substitute ratable taking section for two others brought in by rival subcommittees, after Attorney General William McCraw had intimated both probably were unconstitutional. He presented a ruling from the attorney general his plan would be constitutional. It gives the Railroad Commission the same powers as it has in oil proration, providing that it shall allocate production to reasonable market demand, that it may consider potential and pressure and area, but if acreage is considered, it may be considered only to the extent of the efficient drainage area of a well.

GAS REFRIGERATION LOAD

BOSTON, Mass., Mar. 25.—The value of gas refrigeration as a way of increasing the gas load was stressed by F. E. Sellman of New York, vice president of Servell, Inc., who addressed the meeting of the sales division of the New England Gas Association here.

"From estimates that have come to my attention," Mr. Sellman said, "it appears that the gas refrigerators sold and installed throughout the United States last year added over 2,000,000,000 feet to the national gas consumption, and that without any increase of capital outlay whatever on the part of the utilities."

Mr. Sellman said "there is no doubt that the gas industry is preparing for the biggest year in the history of gas refrigeration." He stated that "during the recent lean years of the depression many gas companies found that the sale of gas refrigerators removed the red ink from their merchandise operations."

KANSAS RATE HEARING

TOPEKA, Kans., Mar. 25.—The final session in the Kansas gas rate investigation is to start April 2, it was agreed by counsel for the Doherty interests and attorneys for the State. The case was set for March 19, but neither side was ready. Attorneys for the Doherty interests are in Washington looking after holding company legislation now before Congress and some of the engineers and accountants for the Corporation Commission are tied up next week in a federal court case.

It was generally expected that a full week, possibly, 10 days, would wind up the taking of the evidence and the submission of exhibits. Attorneys have agreed that when they get the case under way it will continue without further interruption.

Tentative Program for Memphis Meeting Natural Gas Department A.G.A.

Arrangements for the convention of the natural gas department of the American Gas Association, to be held in Memphis, Tenn., May 6 to 9, are being completed. This will be the first separate convention of natural gas men since 1932.

The first general session of the convention is to be held Monday afternoon, May 6, starting at 2 o'clock. The program committee meeting in Memphis decided to devote Monday afternoon, Tuesday, Wednesday and Thursday mornings to general meetings. Tuesday and Wednesday afternoons were set for group meetings divided under two general headings: Gas Sales, Distribution and Utilization in one group, and Production and Transmission in the other. Papers of a technical or semi-technical nature will be presented. Committees were appointed to select subjects and speakers and report their decisions to a subcommittee composed of the chairman, vice chairman and secretary of the department. These three officials will then complete the program.

The committees appointed to line up the program for the group meetings are: Production—Robert Hendee, Tulsa, chairman, and Don Wilson, Pittsburgh; Transmission—E. F. Schmidt, Dallas, chairman, and John Clark, Hope Natural Gas Co.; Sales—W. W. Winter, Atlanta, chairman, and J. V. Strange, Houston.

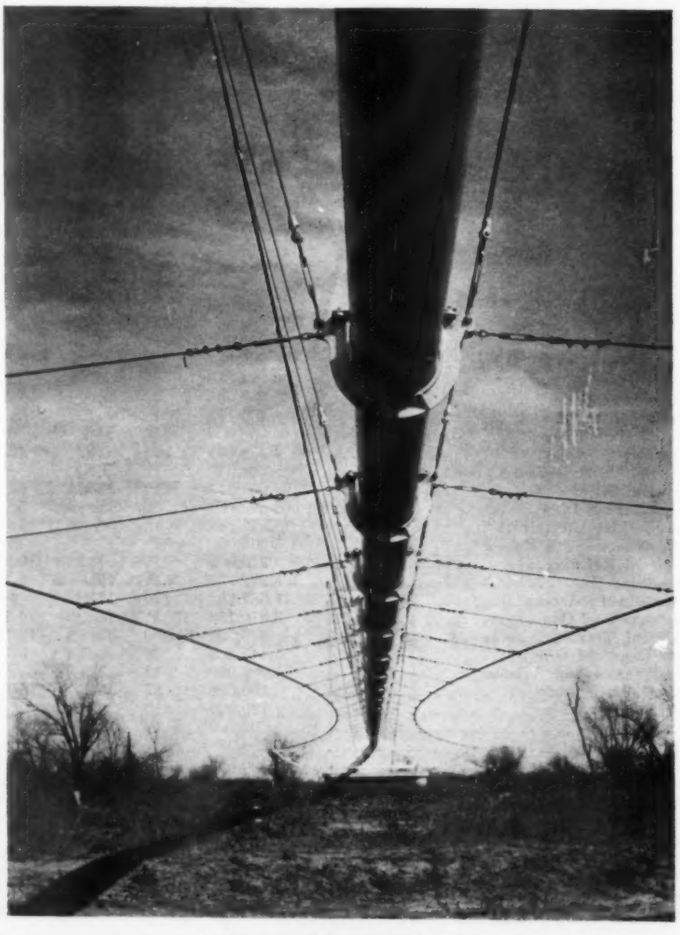
A program was decided on for the general sessions, as follows:

Monday afternoon, May 6—Opening remarks by the chairman, John B. Tonkin. Introduction of Mayor Overton of Memphis by W. J. O'Brien, president of the Memphis Power & Light Co. Chairman's address. Address by Percy S. Young, president, American Gas Association. Review of Association Work, Alexander Forward, managing director, A.G.A. Address, "Taxation and Legislation," Ralph W. Gallagher. Report of program committee outlining for remainder of the session.

Tuesday morning, May 7—This session is to be turned over to the technical committee to select subjects. The report of the technical committee and an address on "Gas Discovery" to include all methods of gas discovery from ancient to modern will be included.

Wednesday morning, May 8—"Wrinkles," H. J. Hoover, Cincinnati. "Natural Gas Fellowships and Educational Progress in Natural Gas Engineering," J. B.

(Continued on Page 174)



Worm's eye view of Arkansas River crossing of 26-inch gas line near Ellinwood, Kans.

Dallas and Fort Worth Unite to Get Gas Tests

DALLAS, Tex., Mar. 25.—Dallas and Fort Worth will share expenses of natural gas tests to be conducted by the U. S. Bureau of Standards and laboratory facilities of Texas Christian University will be used for the work, city councilmen have decided. The debate was in closed session. The vote was four to three in favor of accepting the T.C.U. offer.

Dr. E. P. Schoch, chemistry professor of the University of Texas, will represent the city.

The Lone Star Gas Co. furnishes a stabilized or diluted gas to both cities.

E. R. Weaver, chief of the gas section of the Bureau of Standards, declared here recently dilution is detrimental to the interests of gas company customers.

Three men will accompany Mr. Weaver from Washington soon. The two cities will pay their expenses while the federal Government will pay their salaries.

U.G.I. President Opposes Holding Company Bill

WASHINGTON, D. C., Mar. 25.—John E. Zimmerman, president of the United Gas Improvement Co. of Philadelphia, testified the Wheeler-Rayburn utilities bill "would destroy the permanency of industry of U.G.I." and result in the loss of savings to more than 121,000 stockholders throughout the country.

Appearing before the House Interstate Commerce Committee in opposition to the measure looking toward the elimination of holding companies, Mr. Zimmerman denied U.G.I. was guilty of any of the alleged abuses listed in the bill except the charge of wide distribution of securities.

"The difficulties of disposal or distribution of the assets of a company with such wide interests as U.G.I. are very real," he said. "The loss to investors lies in the fact that under the bill this action is forced; that the mathematical procedure is too complicated to permit the distribution of U.G.I. holdings pro rata among the stockholders."

NO MANHATTAN ELECTION

TOPEKA, Kans., Mar. 25.—Hal E. Harlon, of Manhattan, commissioner of the Supreme Court, has ruled that the city officials of Hutchinson were justified in their refusal to call an election for a vote on a new gas franchise for the Hutchinson Gas Co. Nearly two years ago the city commissioners granted the company a franchise which provided for some reduction in rates over the previous franchise. Following the action of the commissioner, petitions were signed demanding an election on the franchise. There were plenty of signatures, but there was a question of whether many of them actually were electors and entitled to sign the petitions. The commissioners declared there were insufficient legal signatures.

O.N.G. DIRECTORATE

One director was added to the personnel of the Oklahoma Natural Gas Co. directorate at a meeting in Wilmington, Del., March 19. He is Frank P. Johnson, president of the First National Bank & Trust Co. of Oklahoma City, Okla. Other directors are: A. E. Bradshaw, chairman; R. W. Hendee, president; John Mitchell, treasurer; George Frederickson, vice president, Oklahoma City; M. L. Carr, Okmulgee; J. Fred Darby, Muskogee; H. N. Greis, Summers Hardy, Dudley Morgan, C. A. Coakley, C. H. Pape and L. C. Ritts, all of Tulsa.

TYPICAL APPLICATIONS: MAINTAINING THE RATE OF FLOW OF GASES OR LIQUIDS AT A DEFINITE VALUE . . . CONTROLLING THE RATE OF FLOW OF LIQUID OR GAS IN ONE LINE PROPORTIONAL WITH THE RATE OF FLOW IN ANOTHER LINE . . . AND FOR A WIDE RANGE OF PURPOSES SUCH AS CONTROL OF LIQUIDS IN TOWERS AND STILLS.

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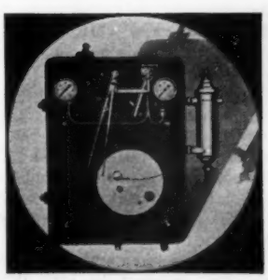

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PERSONAL PARAGRAPHS

CLYDE M. BOGGS, president of the Kanotex Refining Company, of Arkansas City, Kans., was a recent business visitor in Tulsa.

* * *

THEO A. MORGAN, Kansas oil umpire, Wichita, Kans., who has been confined to his home recently with influenza, is again back at his office.

* * *

W. R. K. SCOTT, metallurgist for Jones & Laughlin Steel Corporation, Pittsburgh, Pa., is on a trip through the Mid-Continent and Texas.

* * *

HARRY LINGLE, purchasing agent of the Humble Pipe Line Company, Houston, Tex., was elected president of the Purchasing Agents Association of Houston at its annual meeting recently.

* * *

W. C. NECKERMAN, JR., of Youngstown, Ohio, has arrived in Tulsa to take up his residence as a field man for Republic Steel Corporation. He will be associated with C. S. POWERS, district manager.

* * *

PERCY R. CLARK, Rumanian representative of the Spies Petroleum Company, has been elected chairman of the Rumanian branch of the Institution of Petroleum Technologists for the ensuing year.

* * *

D. V. STROOP, secretary of the central committee on tanker and barge transportation committee of the American Petroleum Institute, announces the appointment of H. A. GILBERT, Oil Transfer Corporation; CHARLES KURZ, Pennsylvania Shipping Company, and C. D. MALLORY, C. D. Mallory, Inc., to membership on that committee.

* * *

W. W. NUGENT, president of William W. Nugent & Company, is spending several months in Jamaica.

* * *

MR. and MRS. C. B. BUNTE, of San Antonio, Tex., are the proud parents of a bady boy born March 16. Mr. Bunte is an independent operator.

* * *

RAN DYER has been transferred from Humble Oil & Refining Company's Baytown refinery to the industrial relations office at Houston, Tex.

* * *

R. E. RETTGER, formerly district geologist in West Texas for the Sun Oil Company, has been transferred to the Dallas, Tex., office as staff geologist.

* * *

J. R. MANION, president of the Sinclair Prairie Pipe Line Company, with headquarters at Tulsa, visited the company's office at Houston, Tex., the past week.

* * *

H. R. SHIDEL, representing the Eagle-Picher Sales Company, and formerly located in the Kansas City office, has been transferred to the home office of the company at Cincinnati, Ohio.

* * *

MISS M. V. SHIFFLER, head of the land department of the Argo Oil Company, has returned to Denver, Colo., headquarters from a vacation in Florida, New Orleans, Georgia, and other southern points.

* * *

M. L. SNYDER, assistant superintendent of Humble Oil & Refining Company's Baytown refinery, has been appointed official representative of the company, to study refining practices and contact other refineries.

G. R. FENNER, Pure Oil Company, Cincinnati, Ohio, has been added to the Kentucky State Petroleum Committee.

* * *

WALLACE E. PRATT, vice president and director of the Humble Oil & Refining Company, was in Corpus Christi, Tex., during the past week.

* * *

WILLIAM LOWE, secretary of the Natural Gasoline Association of America, returned to Tulsa Saturday after spending several days in Austin, Tex.

* * *

RUSH GREENSLADE, vice president of the Gypsy Oil Company and Gulf Pipe Line Company, has returned to Tulsa after a six weeks' vacation in southern Europe.

* * *

LUTHER BELEW, deputy supervisor in the West Central Texas district for the Texas Railroad Commission, has been transferred to Abilene, with W. J. CARDEN, deputy supervisor in charge of conservation work in the Abilene area.

* * *

C. E. ARNOTT, Socony-Vacuum Oil Corporation, New York, was in Washington, D. C., for several days on business with the marketing subcommittee of the Planning and Coordination Committee. Mr. Arnott is chairman of the subcommittee.

* * *

MYRON G. BLALOCK and R. H. DEAS, vice presidents of the Woodley Petroleum Company, and J. R. POPE, secretary-treasurer, are moving their residences from Shreveport, La., to Houston, Tex., the company having transferred its headquarters offices to the latter city.

DONNIE MARSHBANK, veteran oil man of the Breckenridge, Tex., area, visited friends in Fort Worth, Tex., last week, en route from Rumania to California.

* * *

ROBERT C. HEAL, of Petrolia, Ontario, who has been drilling in the Persian fields for the past year for the Anglo-Persian Oil Company, is en route to Canada.

* * *

E. C. RACH, petroleum engineer in charge of the Corpus Christi area for the Texas Railroad Commission, has resigned as of April 1 to join the staff of E. M. JONES, independent operator of San Antonio, Tex.

* * *

W. J. LOUFMAN, Fleet-Wing Corporation, Cleveland; R. D. McCLARAN, Pure Oil Company, Columbus, and J. G. JORDAN, vice chairman, Shell Petroleum Corporation, Cleveland, have been added to the Ohio State Petroleum Committee.

* * *

HAROLD E. THOMPSON, vice president of Carbide & Carbon Chemicals Corporation, has returned to his New York offices after approximately one month of traveling, a part of which time was spent at the company's new plant in Whiting, Ind.

* * *

HUGH S. TAYLOR, professor of Princeton University, and author of "The ABC'S of Science of Oil Recovery," and formerly chairman of the central petroleum committee of the National Resource Council, addressed the New York section of the American Society for Testing Materials several days ago on "The Chemistry of Deterioration."

* * *

C. L. JONES, Socony-Vacuum Oil Corporation, New York, was in Washington, D. C., for several days on business.

* * *

EDGAR T. JACKSON has been added to the insulation division of the Eagle-Picher Sales Company, with headquarters in the Tulsa office.

* * *

M. A. DRESSER, of the Carter Oil Company, was in Denver, Colo., the past week from Lamar, Colo., and may be stationed in Denver permanently.

* * *

MR. and MRS. DON DANVERS are the parents of a young son, born to them March 9. Mr. Danvers is an independent operator, with headquarters at Laredo, Tex.

* * *

W. J. ANDREE, with the Sinclair Prairie Pipe Line Company, with headquarters at New York, was a business visitor to the company's offices at Houston, Tex., last week.

* * *

B. L. MAJEWSKI, receiver for Deep Rock Oil Corporation, Chicago, spent a couple of days in Washington, D. C., attending meetings of the marketing subcommittee of which he is a member.

* * *

JOHN H. ROSS, president of the Inland Water Petroleum Carriers Association, Eastern Division, was in Washington, D. C., attending hearings before the Senate Finance Committee.

* * *

L. W. MacNAUGHTON, chief geologist for the Amerada Petroleum Corporation, with headquarters at Houston, Tex., attended the convention of the American Association of Petroleum Geologists held at Wichita, Kans., the past week.

DO YOU REMEMBER?

From The Oil and Gas Journal Files

25 Years Ago

March 25, 1910

Murray Doan, for eight years connected with the Sun Company at Beaumont, Tex., has resigned to go with the Gulf Pipe Line Co. of Oklahoma with headquarters in Tulsa.

Nelson K. Moody, recently returned from Rumania where he was in charge of the Standard Oil Co.'s field operations, has taken over his duties as head of the production department and assistant general manager of the Prairie Oil & Gas Co. Some of the old-timers opine that Nelse "is a pretty young feller to be holdin' down such a big job."

The Lakeview Oil Co. drills in a gusher in Section 25-12-24, in the Midway Field in California. It's production is estimated all the way from 30,000 to 50,000 bbls. It started flowing March 15 from a total depth of 2,260 feet. The well was started January 2, 1909, and cost $25,000 to drill. The oil is reported to be 24 degrees in gravity.

20 Years Ago

March 25, 1915

The Oklahoma legislature has passed a bill which places a 2 per cent production tax on the crude oil produced in the state. The bill is satisfactory to producers especially to owners of stripper well properties.

M. S. Musselman came to Oklahoma from Syria three years ago. He bought a 72-acre tract of land 1½ miles south of Oilton for $362.50. He bought it from a slick Tulsa real estate man without having seen it. He thought he was buying a truck farm. When he went to look it over he groaned in spirit. It consisted of hills and hollows of rocks and hardpan. But the Cushing Field was extended to the "farm" and now it is worth $2,600,000, and Mr. Musselman still owns it.

10 Years Ago

March 26, 1925

Huasteca well No. 44 Tierra Blanca in Mexico completed with a flow estimated at between 100,000 and 200,000 bbls. and extending the field.

American companies secure 30 per cent interest in Iraq development after prolonged negotiations.

Eastern pipe line men honor P. F. Egan, field superintendent for the Southwest Pennsylvania Pipe Lines, on his retirement after 45 years of service with the company.

MARVIN A. SMITH, of the Eagle-Picher Sales Company, has been transferred from the Tulsa office to the Dallas, Tex., office, and will work in both territories.

* * *

ALVIN A. BURTON, who recently was awarded the Ph.D. degree at the University of Illinois, has joined the research and development department of the Standard Oil Company of California at Richmond, Calif.

* * *

CHARLES PEARSON, of Calgary, Alberta, district representative of the North Star Oil Company, visited Cranbrook and nearby British Columbia points recently in connection with extensions being made by his company.

* * *

C. C. SPICER and H. H. MADDREN were re-elected president and vice president of the Republic Petroleum Corporation at the annual meeting held in Los Angeles recently. DAVID FARIES was re-elected chairman of the board of directors.

* * *

DUDLEY M. STEELE, manager of the Richfield Oil Company's aviation department and who has had a long and varied career, was the principal speaker at the meeting of the Los Angeles Petroleum Accountants Society at the University Club.

* * *

W. MIKE MURPHY, pipe line engineer, applied engineering department of Air Reduction Sales Company, has been in Los Angeles for the past two weeks in connection with pipe line construction by Standard Oil Company and General Petroleum Corporation.

* * *

DR. JOSEPH E. POGUE, consultant, New York City, was visiting with friends in Tulsa this week.

* * *

ERNIE RICHARDS, with National Tank Company, Tulsa, spent a large part of last week in Kansas fighting dust storms.

* * *

R. G. DE LA MATER, engineer, Parkersburg Rig & Reel Company, Parkersburg, W. Va., was in Tulsa last week on company business.

* * *

J. E. McCONNELL, JR., of Houston, Tex., has been named a director of the Standard Oil Company of Kansas, replacing L. T. BARNESON, resigned.

* * *

CHARLES W. TEATER, independent producer, of Mount Pleasant, Mich., has recovered sufficiently from serious injuries received last fall to take an active part in operation of his leases.

* * *

W. K. ATCHESON, president of the Petroleum Motor Transport Association, is convalescing at St. Johns Hospital, Tulsa, following a major operation. Complications delayed his recovery. He is head of the motor transport division of the Pure Oil Company in Tulsa.

* * *

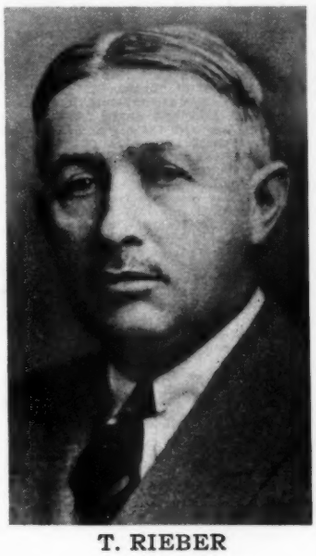
DR. R. P. ANDERSON, secretary of the committee on testing methods and specifications of the division of refining of the American Petroleum Institute, has announced the resignation of A. R. LANGE, Swan-Finch Corporation, from membership on that committee.

* * *

RICHARD MATHER YOUNG, JR., and his bride, the former MISS ADELE JOHNSTON, of Los Angeles, Calif., were in Tulsa for a several hours' visit with Mr. Young's homefolk before leaving for New York City, en route for Bermuda to spend their honeymoon. The wedding of Mr. Young and Miss Johnston, the daughter of MR. and MRS. FRED B. JOHNSTON of Los Angeles, was celebrated Wednesday in St. Matthews Episcopal Cathedral in Dallas, Tex. Mr. Young, who is now living in Houston, Tex., is the son of MR. and MRS. R. M. YOUNG of Tulsa. Mr. and Mrs. Young will be at home in Houston after April 15.

He Is at Home Almost Anywhere

One of the most widely known of American oil men in foreign oil circles is T. Rieber, vice president and director of the Texas Corporation and the Texas Company in charge of the export and marine departments. The sun never sets on the marketing operations of the Texas Company and Mr. Rieber is a frequent visitor to many points in these widely scattered distributing operations in foreign countries. The sign of the Texaco under Mr. Rieber's supervision has been placed in most of the large consuming centers throughout the entire world with many remote points served with the company's products. He has come to be known as one of the most traveled men in the oil industry and he feels at home almost anywhere.



T. RIEBER

Mr. Rieber joined the Texas Company in 1905 in the early stages of its development. He served in various capacities in the marine and refining departments until 1919 when he resigned to become associated with the J. S. Cullinan interests.

In October, 1927, he severed his connection as vice president of the American Republics Corporation to return to the Texas Company to assume his present position as head of its export and marine departments. The latter operations include fleets of tankers and barges as well as a large number of water terminals in all the continents with refining interests.

H. L. DICKSON, district manager, Parkersburg Rig & Reel Company, Tulsa, was on a business trip in Texas last week.

* * *

FRED BYRON, of Spring Coulee, Alberta, is engaged with the Terminal Oil Company of Los Angeles, Calif., on a deep test on the Del Bonita structure near Lethbridge, Alberta.

* * *

RALPH HORWEEN, Chicago, was in Tulsa the latter part of the week. He was formerly an assistant to OIL ADMINISTRATOR ICKES. He was in Tulsa in connection with his duties as counsel for the Johnson Oil Refining Company. He planned to visit the Fitts Field and East Texas before returning to Chicago.

* * *

HARRY H. WOODRING, Assistant Secretary of War, will speak before the annual spring meeting of the American Petroleum Institute's Mid-Continent production division at Amarillo, Tex., April 11, on "National Defense." His address, to be delivered on the second day of the meeting, will detail necessity of petroleum to the army and navy in time of war.

* * *

S. G. DOLMAN, veteran deputy supervisor of the California State Mining Bureau, has been returned to duty at Santa Barbara following the submission of a petition to Governor Merriam signed by more than 80 per cent of all operators in the Santa Barbara Mesa district. Mr. Dolman was retired as an economy move and J. B. CASE transferred to Santa Barbara. Coincident with Mr. Dolman's reinstatement, Mr. Case has returned to his former position in Los Angeles as chief-field deputy.

* * *

GEOLOGISTS from Denver, Colo., attending the annual meeting of the American Association of Petroleum Geologists at Wichita, Kans., included H. A. STEWART, F. H. GOWER, and E. H. HUNT, of the Texas Company; W. A. WALDSCHMIDT, president of the Rocky Mountain Association of Petroleum Geologists; A. E. BRAINARD and C. S. LAVINGTON, of the Continental Oil Company; C. E. SHOENFELT, of Petroleum Information, Inc.; HERMAN DAVIES, of the California Company, and CHARLES T. LUPTON.

ARTHUR E. JOHNSON, president of the Argo Oil Company, and affiliated organizations, has returned to the Denver, Colo., headquarters from a business trip to New York.

* * *

G. L. PACE, lately with the production department of the Texas Company at Houma, La., has been transferred to Houston, Tex., where he has been made safety engineer.

* * *

UNDERWOOD NAZRO, vice president of the Gulf Production Company, with headquarters at Houston, Tex., has returned to his desk after spending several weeks in the Mayo clinic at Rochester, Minn.

* * *

WILMER SCHUH, president of the National Association of Petroleum Marketers, Chicago, attended the recent meetings of the marketing subcommittee of which he is a member. The meetings took place in Washington, D. C.

* * *

H. A. GILBERT, president of the Oil Transfer Company, New York, was in Washington, D. C., for several days attending hearings on the proposed legislation to regulate and co-ordinate all forms of transportation including water transportation.

* * *

AMONG the vice presidents of the chemical engineering congress, to be held at Westminster, London, England, June 22 to 27, is SIR JOHN CADMAN; and members of the organizing committee include DR. A. E. DUNSTAN, DR. W. R. ORMANDY, and DR. F. S. SINNATT.

* * *

PAUL E. FITZGERALD, consulting geologist with Dowell Incorporated, Midland, Mich., is making a tour of the Mid-Continent and Rocky Mountain oil fields for that company.

* * *

F. M. BYNUM, vice president of C. D. Mallory & Company, New York, has been appointed a member of the American Petroleum Institute's Central Committee on Tanker and Barge Transportation. Mr. Bynum succeeds CLIFFORD D. MALLORY, who resigned because of illness.

* * *

ALBERT O. PEGG, president of the Wilmington Chamber of Commerce and superintending engineer of the Union Oil Company at Los Angeles harbor, and ARTHUR WOLL, marine superintendent of General Petroleum Corporation are members of a committee appointed for the purpose of adjusting the anchorage problem at the Los Angeles harbor which has become rather crowded due to restrictions placed on the roadstead by the Navy Department.

* * *

H. F. MOSS and C. P. GODSEY, formerly of the Denver, Colo., offices of the Carter Oil Company, have been stationed at Mount Pleasant, Mich., where the Carter company is preparing for new operations. The Carter company may take over leases now held by the Ohio Producing & Refining Company in Central Michigan, it was reported. C. P. ERNI and OKEY WHEELER are Michigan representatives of the Ohio company, a Standard subsidiary.

* * *

ALLEN R. HALL, former chief clerk in charge of the Porter Township district production office of the Pure Oil Company in Michigan, has returned to his home in Tulsa. He has been succeeded by CARL F. LYLE, former chief clerk of the Pure's Greendale district office in Central Michigan. MARK MURPHY, formerly assistant to LEO K. HUGHES, chief production clerk in the Saginaw, Mich., offices of the company, has been named to succeed Mr. Lyle. KARL JOCKEN, clerk in the Porter district office, has been transferred to Saginaw to assist Mr. Hughes and DEL EDWARDS, of the material department, Saginaw, has been transferred to the Porter district production office.

Metallizing Important in Prevention of Corrosion

(Continued from Page 99)

a large job of that sort for the Ozark Chemical Co. at Tulsa.

Aluminum for Chambers

Since April 1934, the Tide Water Oil Co. contracted the lining of six of the chambers located at their Drumright, Okla., refinery. Three of these are vertical coking units operating at high temperatures and three were accumulators in the temperature range that may present a problem in the presence of more complex reactions.

In April we shall be called to Cushing to line with aluminum another chamber for the Deep Rock Oil Corp. In January of this year a bubble tower was partially covered for Marathon Oil Co. at their Bristow plant. During December, 1934 one of the dephlegmators owned by Derby Oil Co. at Wichita, Kans., was protected with .018 inch of pure aluminum. Heat exchangers were sprayed with admiralty metal for the Sunray Refinery at Allen, Okla. Two agitator roofs have been lined with .030 inch of chemical lead for the Mid-Continent Oil Corp. refinery at Tulsa.

In August of 1934, the Ashland Refining Co. of Ashland, Ky., decided to line one of their chambers and purchased their own equipment. Since then we have shipped a second unit to the Lion Oil Refining Co. and this last month we trained two mechanics from the Panhandle Refining Co. of Wichita Falls, Texas, who took with them the complete outfit with which they will work.

On April 5 we will start our first job for the Texas Co., about 600 square feet in a coke chamber to determine whether or not the same results can be accomplished in their chamber as in others. On April 1 we are expecting to line the second 9' x 54' bubble tower for the Shell Petroleum Corp. at Wood River.

Question of Metallizing

During a recent committee meeting of engineers representing several different oil companies, the question of metallizing came up for discussion and recommendation. This committee's decision was briefly, that based upon the experience of their own companies, they could not recommend the process, that after about one year in service, aluminum coatings on reaction chambers had blistered indicating break down. Some of the companies this committee represented had practically no experience at all. Two had had a bad experience years ago and five have since purchased metallizing equipment. Of the other three, one has regularly contracted the metallizing of chambers and of hot oil pump plungers for 18 months and one after 16 months trial with aluminum in chambers, is lining completely the inside of about 15 new chambers to be installed in two of its refineries. The third has owned two metallizing units for 18 months and has successfully completed a greater number of different kinds of work around a refinery than any other user. Their work includes the lining of a number of cracking unit vessels with aluminum. It is difficult to reconcile such statements but we hope that next year the committee will avail itself of the opportunity presented to it to secure complete data.

It seems to have been definitely established that aluminum linings for high temperature, high pressure equipment has arrived. The initial expense is no greater than for ganister because only those portions of the vessels that need protection are covered with aluminum. The aluminum does not spall to foul the valves nor does it have to be removed for inspection. In reaction chambers of smaller size, higher octane gasoline may be obtained where the diameters are not reduced by 3". The repairs at each inspection period are quite inexpensive and the time off stream is reduced appreciably.

Gulf Coast Wildcats

(Continued from Page 146)

48 deg. E and 330 ft. N, 42 deg. E of W cor. of lease, Thomas Sproggins Sur., Abst. A-366.
7-in. csg. 4,103 ft.; I.P. 14 bbls. per hr.; tubing pressure 400 lbs. through ¼-in. choke.

Texas Co.'s No. 2 Dawson, 247 ft. S, 241 ft. W of NE cor. of Lot 58, H.T.&B. Sur. No. 23.
Location.

Texas Co.'s No. 1 L. C. Dawson, 247 ft. S, 441 ft. W of NE cor. of Lot 49, H.T.&B. Sur. No. 23.
10-in. csg. 1,116 ft.

Texas Co.'s No. 2 Dawson, 247 ft. S, 441 ft. W of NE cor. Lot 48, H.T.&B. Sur. No. 23.
10-in. csg. 1,130 ft.; drlg. shale and lime 2,810 ft.

Texas Co.'s No. 3 F. Lieder, 247.5 ft. S and 247.5 ft. E of NW cor. of Lot No. 3. A.C.H.&B. Sur.
Moving in rig.

Trumba Oil Co.'s (J. M. Campbell) No. 1 H. McCauley, 150 ft. each way out of NE cor. of W 5 acres of Lot No. 2, A.C. H.&B. Sur. No. 91.
Location.

Windsor Oil Co.'s No. 2 Colby, 660 ft. SW of No. 1, center of tract N and S Tract 20, T. Spraggins Sur.
Drlg. shale and lime 4,510 ft.

PLEDGER—BRAZORIA COUNTY

Humble O. & R. Co.'s No. 1 T. L. Smith, 1,283 ft. NE from W cor. of 88.86-ac. lease, thence 887 ft. SE at R/A, D. McNeel Sur.
Rig up.

STRATTON RIDGE—BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 1 Seider & State, 225 ft. due N of No. 3.
Fishing 4,755 ft.

Thompson Drlg. Co.'s No. 1 Seaburn Est., Austin & Williams one-half league.
T.D. 4,770 ft.; stuck drill pipe at 4,300 ft.; sidetracking.

WEST COLUMBIA—BRAZORIA COUNTY

Sterling O. & R. Co.'s No. 4 Hogg, 200 ft. S of No. 1, 50 ft. from W line of lease, Martin Verner Sur.
T.D. 5,298 ft.; cmt. back to 4,850 ft.; drilled out cmt. to 5,190 ft.; S.D.

Texas Co.'s No. 84 Hogg, 2,482 ft. N, 50 ft. W from SE cor. of lease, M. Varner Sur. Temporarily S.D. 5,342 ft.

ANA HUAC—CHAMBERS COUNTY

Humble O. & R. Co.'s No. 1 J. J. Clark, 466 ft. N of S line and 466 ft. W of E line of H.&T.C. Sur., Sec. 64.
Location.

Humble O. & R. Co.'s No. 2 Middleton, 466 ft. out of NE cor. of H.&T.C. Sur., Sec. 64.
Location.

BARBERS HILL—CHAMBERS COUNTY

Humble O. & R. Co.'s No. 3-B Kirby, 200 ft. N of No. 2, 100 ft. W of E line, Henry Griffith League.
Drlg. shale 4,654 ft.

McAlbert Oil Co.'s No. 3-B Heggins, 50 ft. S of N line and 50 ft. E of W line.
Drlg. rock 1,358 ft.

Sun Oil Co.'s No. 15 Wilburn, 405 ft. from E and 50 ft. from W line of lease, Wm. Hodges Sur.
Drlg. shale and sand 5,475 ft.

Sun Oil Co.'s No. 17 Wilburn fee, 185 ft. E of W line and 40 ft. S of N line and 120 ft. W of No. 16.
Drlg. shale and lime 2,998 ft.

Texas Gulf Prod. Co.'s No. 3 Fitz, 450 ft. E of W line, 75 ft. N of S line.
Building derrick.

Texas Gulf Prod. Co.'s No. 12-A Kirby, 613 ft. N of S line, 85 ft. W of E line, W of Humble O. & R. Co.'s No. 8-B Kirby.
Top salt 2,208 ft.; drlg. salt 2,335 ft.

Texas Gulf Prod. Co.'s No. 2 Morgan Fitzgerald, 400 ft. N of S line, C of Strip No. 3.
Drlg. shale 5,342 ft.

Texas Gulf Prod. Co.'s No. 2 Fitz-Meadows, 281 ft. S of N line, 50 ft. W of E line of Lot of T. S. Fitz lot.
Drlg. rock 678 ft.

Mount Lee Oil Co.'s No. 28 Chambers County, 50 ft. N of S line, direct offset to Sun's No. 10 Chambers County, Wm. Bloodgood Sur.
Drlg. salt 1,790 ft.

BIG CREEK—FORT BEND COUNTY

Trans-State Oil Co.'s No. 2 Ahlers, 85 ft. N of Gulf Stream, Inc.'s No. 1 Ahlers, Michael Young Sur.
10-in. csg. 210 ft.; drlg. plug.

BOLING—FORT BEND COUNTY

Allied Minerals, Inc.'s No. 1 E. C. Farmer James Scott League, 750 ft. SE of NW line and 150 ft. SW of NE line of Gulf Prod. Co.'s E. C. Farmer 50-ac. tract.
Replugging the hole.

Irwin Larsen et al's No. 1 J. R. Farmer, 100 ft. NW and 100 ft. SW from E cor. of 125-ac. lease, James Scott Sur.
Location.

Midland Oil Co.'s No. 1 P. F. Coulter, 150 ft. from S line, 4,174 ft. from W line of 100-ac. tract, Miller League No. 2.
Set screen; T.D. 4,186 ft.

Navarro Oil Co.'s No. 1 H. R. Farmer, 300 ft. from SW line and 100 ft. from SE line of 168-ac. tract in James Scott Sur.
7-in. csg. 4,000 ft.; T.D. 4,297 ft.

Trans-State Oil Co.'s No. 1 Dipple, 480 ft. from NW and 347 ft. from SW lines of 33-ac. tract, E flank of dome.
Drlg. rock 2,700 ft.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 42 Moore, 345 ft. S. 305 ft. W of SW cor. of E.M.G. Co. Sur.
Drlg. caprock 1,610 ft.

Gulf Prod. Co.'s No. 43 Moore, 350 ft. E along S line of SW cor. of E.M.&G. Co. Sur. and 740 ft. N at R/A to said line of lease, 350 ft. E of No. 3 Moore.
Rig up.

THOMPSON—FORT BEND COUNTY

Gulf Prod. Co.'s No. 1-B Gehr, 340 ft. from S line of lease, 640 ft. E of Naylor Oil Co.'s No. 7 Gehr, L. Kennedy Sur.
Drlg. shale and lime 4,850 ft.

Gulf Prod. Co.'s No. 1 F. I. Booth, 2,777 ft. from L line and 340 ft. from SE cor. of 202-ac. tract, H. Cristman Sur.
Drlg. 2,400 ft.

Gulf Prod. Co. and Humble O. & R. Co.'s No. 24-A Booth, 486 ft. from N line of 1,107-ac. lease and 893 ft. W of No. 22-A, S. Kennedy Sur.
Location.

HIGH ISLAND—GALVESTON COUNTY

Yount Lee Oil Co.'s No. 45 Cade.
Drlg. shale and lime 4,424 ft.

Yount Lee Oil Co.'s No. 23 Smith.
T.D. 4,956 ft.; running tubing; I.P. 60 bbls. per day.

Yount Lee Oil Co.'s No. 1-A Gordon-Viterbo, 122 ft. E of W line, 326 ft. S of N line of Lot 1, Martin Dunman Sur.
Drlg. sand and shale 2,790 ft.

Yount Lee Oil Co.'s No. 1 Loustalbot, 300 ft. from N line, 121 ft. from E line of Lot No. 3, offset to No. 2 Stewart, Martin Dunman Sur.
9⅝-in. csg. at 1,678 ft.; T.D. 1,711 ft.

Yount Lee Oil Co.'s No. 1 F. C. Pabst, 1,186 ft. S of N line and 1,186 ft. E of W line of Lot 32, Martin Dunman Sur.
Drlg. hard sand 4,446 ft.

Yount Lee Oil Co.'s No. 44 Cade.
T.D. sidetracked hole 4,856 ft.; I.P. 60 bbls. per day.

DICKINSON—GALVESTON COUNTY

Humble O. & R. Co.'s No. 3-A Stewart, 338 ft. S of easterly NE cor., 2,016 ft. W of easterly E line, 425 ft. S of S line of Bayou, John Sellers Sur.
Rig up.

Humble O. & R. Co.'s No. 2-A Maco Stewart, 3,324 ft. S along E line of S bank of Bayou and 566 ft. W of E line at R/A, John Sellers Sur.
Rig up.

Humble O. & R. Co.'s No. 1 Schaper, C 8½ of Blk. 15, or on line between Lots 3 and 4 and center N and S. W. K. Wilson Sur.
Coring sand and shale 8,557 ft.

Humble O. & R. Co.'s No. 1 A. F. Danielson, C of 20-ac. tract, Lots 5 and 6, C. A. Anderson Subd. of Lot 15, of the Righter Subd., John Sellers Sur.
Coring sand 9,114 ft.

ARRIOLA—HARDIN COUNTY

Houston Oil Co. and Republic Prod. Co.'s No. 5-X fee, E Arriola Sur.
Drlg. sand 2,875 ft.

Republic Prod. Co's No. 11 fee, E. Arriola Sur.
13⅜-in. csg. at 1,258 ft.; W.O.C.

BATSON—HARDIN COUNTY

Sterling O. & R. Co.'s No. 1 Doucette, 565 ft. N from NE cor. of Nunn tract thence 565 ft. E at R/A, Wm. Donoho Sur.
Rig up.

John Deering's No. 1 Bullock, 1,000 ft. N, 17 ft. E of middle line of 30-ac. tract, Bullock tract, Dondo Sur.
Rig up.

John Deering's No. 2 Hooks.
Drlg. shale 1,730 ft.

John Deering's No. 2 Cruse, 200 ft. E and 50 ft. S of No. 1 Cruse, W. Donaho Sur.
Rig up.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 11-N Jordit, 200 ft. due W of No. 11-R Jordit.
Clearing location.

SOUR LAKE—HARDIN COUNTY

Arlis Pet. Co.'s No. 1 Harkan and Langham, Dig pits.

Alpha Pet. Co.'s No. 2-A Wm. Weiss, 100 ft. W of No. 2.
T.D. 6,808 ft.; set 5 9/16-in. drill pipe at 6,760 ft.; perforated csg. from 6,751-60 ft.; flowing 10 bbls. per day by heads; may abd.

Sun Oil Co.'s No. 2 Bernard Corp., 150 ft. from N and W lines of Lot 11, H.T.&B. Sur., Sec. 69.
Abd.; T.D. 7,420 ft.

Texas Co.'s No. 318 fee, midway between No. 265 and 274.
Drlg. 308 ft.

GOOSE CREEK—HARRIS COUNTY

Humble O. & R. Co.'s No. 80 Simms-Smith, Scott Lower League, 1,000 ft. E of the most westerly W line, and 300 ft. N of the most northerly S line.
T.D. 6,254 ft.; P.B. to 6,222 ft.; cutting and pulling 8⅝-in. csg.

PIERCE JUNCTION—HARRIS COUNTY

Gulf Prod. Co.'s No. 32 Taylor.
Drlg. shale 3,976 ft.

Rio Bravo Oil Co.'s No. 27-A Settegast, 377 ft. S, 552 ft. W of NE cor. of Settegast "A" tract, James Hamilton Sur.
Standing 5,526 ft.

Rio Bravo Oil Corp.'s No. 9-A Settegast, 1,575 ft. N line, 350 ft. E line NE cor "A" lease, J. A. Kopman Sur.
T.D. 5,411 ft.; standing.

MYKAWA—HARRIS COUNTY

J. W. Falvey's No. 2 Minnetex, 150 ft. from S line and 37.5 ft. from E line of Blk. 192, Wm. Lovett Sur.
Drlg. shale and lime 4,910 ft.

West Prod. Co.'s No. 1 Cora Holmes, C of 10ac. tract, A. J. Rothas Sur., Blk. 11.
Drlg. shale 3,910 ft.

West Prod. Co.'s No. 1 T. F. Reed, 403 ft. from E line and 270 ft. from N line of lease, F. J. Rothas Sur., Abstract 667, Blk. 8.
Drlg. shale 610 ft.

TOMBALL—HARRIS COUNTY

Amerada-Stanolind O. & G. Co.'s No. 1 H. G. Feiber, Elizabeth Smith Sur.
Washing in 5,571 ft.

Amerada-Stanolind O. & G. Co.'s No. 2 Bode, 500 ft. from N line and 500 ft. from W line of 40-ac. lease, J. M. Hooper Sur.
T.D. 5,585 ft.; washing in; 366 bbls. per day through ¼-in. choke.

Humble O. & R. Co.'s No. 2 Gossett, 363 ft. from NW line, 328 ft. from SW line, E. Smith Sur.
10¾-in. csg. at 930 ft.; drlg. shale 2,160 ft.

Humble O. & R. Co.'s No. 5-A Quilter, 980 ft. from S line, 466 ft. from W line of 300-ac. tract, A. Senchel Sur.
Spudded.

Humble O. & R. Co.'s No. 1 Scherer, 224 ft. from E line, 300 ft. N of line projected W through Shell Pet. Corp.'s No. 1-A Theis, J. House Sur.
10¾-in. csg. at 959 ft.; spudded.

Humble O. & R. Co.'s No. 1 Stallones, 505 ft. from E line, 365 ft. from N line, J. Hooper Sur.
10¾-in. csg. at 924 ft.

Humble O. & R. Co.'s No. 4-A Quilter, 1,250 ft. from S line, 466 ft. from E line of 300-ac. tract, A. Senchel Sur.
T.D. 5,564 ft.; 7-in. csg. 5,553 ft.; I.P. 28 bbls. per hr. through ¼-in. choke; tubing pressure 700 bbls.

Humble O. & R. Co.'s No. 2 Theis, 2,718 ft. from N line, 584 ft. from E line of tract, C. N. Pillott Sur.
T.D. 5,566 ft.; 7-in. csg. 5,566 ft.; I.P. 2,180,000 ft. of gas per day through ¼-in. choke.

Humble O. & R. Co. et al's No. 3 Rudel, 1,750 ft. N of S line, 185 ft. E of W line of 90-ac. tract, J. House Sur.
Top sand 5,587 ft.; T.D. 5,600 ft.; 7-in. csg. 5,593 ft.; setting screen.

Texas Co.'s No. 3 Ziegler, 1,449 ft. E of W line and 446 ft. S of N line of lease, 930 ft. E of No. 1.
Rig up.

KITTRELL—HOUSTON AND WALKER COUNTIES

Humble O. & R. Co.'s No. 8 Shaw, 330 ft. from SE line, 420 ft. from SW line, C. McEllis Sur.
10¾-in. csg. 318 ft.

Sun Oil Co.'s No. 2 Huffman, 660 ft. NW of No. 1, Charles McEllis Sur.
Prepare to test 1,995 ft.

VANDERBILT—JACKSON COUNTY

Imperator Oil Co.'s No. 1 Dutton, S C of Lot No. 11, Blk. 25, 450 ft. S of R.R. and 1,350 ft. W line of townsite, Ray Musquiz Sur.
Rigged up and S.D.

Turman Oil Co.'s No. 1 T. H. Miller, 150 ft. each way out of E 50 ac. of Miller 100-ac. tract in Ray Musquiz Sur.
Rigging up.

BIG HILL—JEFFERSON COUNTY

Yount Lee Oil Co.'s No. 1-A Pipkin, 2,640 ft. S and 2,050 ft. W of NE cor. of survey.
T.D. 6,341 ft.; whipstock at 6,040 ft.; drlg. heaving shale 6,229 ft.

FANNETT—JEFFERSON COUNTY

Gulf Prod. Co.'s No. 16 Thomas, 650 ft. N of S line, 165 ft. W of E line of W. H. Smith League.
T.D. 4,261 ft.; I.P. 386 bbls. in 24 hrs. through ½-in. choke; tubing pressure 325 lbs.

CLEVELAND—LIBERTY COUNTY

Black Gold Pet. Oil Corp.'s No. 2 R. D. McDonald, 466 ft. W of most westerly E line and 466 ft. N of most northerly S line of survey, 933 ft. W of Gulf Prod. Co.'s No. 7-C Kirby Lbr. Co., T. Devers Sur.
Derrick.

William J. Colegrove et al's No. 1 State School Land & Dev. Co., 446 ft. from W line and 170 ft. from S line of survey, Clayton Harper Sur.
Location.

Gulf Prod. Co.'s No. 1 R. D. McDonald, 467 ft. from N and E lines of lease and survey, Chas. Smith Sur.
10¾-in. csg. at 997 ft.; drlg. shale 2,260 ft.

ESPERSON—LIBERTY COUNTY

General Crude Oil Co.'s No. 21 Esperson.
Drlg. shale 4,019 ft.

General Crude Oil Co.'s No. 1 W. D. Kay, Malcolm Duncan Sur., 1,527 ft. along N T.D. 6,655 ft.; P.B. to straighten hole.

General Crude Oil Co.'s No. 10 Davis, 2,000 ft. from E line, 660 ft. from S line of D. Kokernut Sur.
Drlg. shale 5,123 ft.

HANKAMER—LIBERTY COUNTY

Cretaceous Oil Co.'s No. 2 S. E. Ezzell, 150 ft. S of N line, 100 ft. W of E line of Ezzell's 75-ac. tract, Levi Barrow Sur.
10¾-in. csg. at 1,238 ft.

Eljean Oil Co.'s No. 1 Ezzell, 1,325 ft. from N, 150 ft. from E line of Ezzell 175-ac. tract.
Rig up.

Gulf Prod. Co.'s No. 1 Hankomer, 330 ft. W, 420 ft. N of SE corner of George Stingler Survey.
10¾-in. csg. 1,238 ft.

Jones Drlg. Co.'s No. 1 Ezzell, 1,050 ft. S of N line, 150 ft. W of E line of Levi Barrow Sur.
Rig up.

Will Strozier et al's No. 1 Ezzell, 700 ft. N of S line, 150 ft. W of E line of Levi Barrow Sur.
Building derrick.

Wilson-Broach Oil Co.'s No. 1 Barrow, 150 ft. N of S line, 100 ft. W of E line, W. M. Crook et al, Levi Barrow Sur.
13⅜-in. csg. at 600 ft.; drlg. rock 1,131 ft.

HULL—LIBERTY COUNTY

G. R. Brown and S. F. Bashara's No. 1 David Hannah, Jesse Devore league, 300 ft. S line, 150 ft. E line, 42-ac. Gulf tract.
Derrick

Republic Prod. Co.'s No. 145 Dolbear, Jesse Devore.
Drlg. sandy shale 2,623 ft.

Republic Prod. Co.'s No. 155 Dolbear, Jesse Devore Sur.
Rig up.

Gulf Prod. Co.'s No. 107 Phoenix, 400 ft. W of No. 106, and 400 ft. N of No. 103, J. Devore Sur.
Location.

Texas Co.'s No. 2 Barrow
6⅝-in. csg. 3,319 ft.; S.D. 4,355 ft.

BUCKEYE—MATAGORDA COUNTY

United North & South Dev. Co.'s No. 1 Unit 4, Buckeye farm, J. C. Keller league, 214 ft. N line and 202 ft. E line of lease Shut down.

CONROE—MONTGOMERY COUNTY

Humble O. & R. Co.'s No. 6 Pfaeffilin, 413 ft. N of No. 1, 633 ft. from W line of lease, Wm. Real Sur.
Drlg. shale 3,952 ft.

Houston Oil Co.'s No. 12 Cartwright, 933 ft. E of No. 11, 933 ft. N of No. 9.
Drlg. shale 1,513 ft.

Sun Oil Co.'s No. 22 Foster, J. Brecker Sur.
Drlg. shale 3,508 ft.

SPLENDORA—MONTGOMERY COUNTY

Bryce McCandless et al's No. 1 Texas Long Leaf Lbr. Co., 330 ft. from N and E lines of the W½ of Blk. No. 8, Walker County School Land Sur.
Derrick.

ORANGE—ORANGE COUNTY

Trio Oil Co.'s No. 1 D. S. Comier, 69 ft. W of E line and 39 ft. S of N line of 6.88-ac tract in W. M. Dyson Sur.
Drlg. gumbo 2,830 ft.

TOM O'CONNOR—REFUGIO COUNTY

Quintana Oil Co.'s No. 7-A O'Connor, 1,400 ft. SE of section, 4,199 ft. from SE line of survey.
Spudded.

Quintana Oil Co.'s No. 2-B O'Connor, 500 ft from W line, 260 ft. from S line of M. L. White Sur.
T.D. 3,763 ft.

Quintana Oil Co.'s No. 6-A O'Connor, J. M. Swisher Sur., Blk. 4.
Prepare to spud.

PORT NECHES—ORANGE COUNTY

Port Neches Pet. Corp. et al's No. 1 W. B Organ, 450 ft. from NE line and 150 ft from NW line of A. Schramm Sur., S of Port Neches Field.
Drlg. shale 3,988 ft.

Texas Co.'s No. 3-B Polk, 200 ft. S, 450 ft W of SE cor. of Mary E. Hall Sur. No. 8
T.D. 5,933 ft.; pulled in derrick.

Texas Co.'s No. 3 Orange National Bank, 750 ft. S of N line and 295 ft. E of W line of lease, Jacob Beaumont Sur.
Drlg. shale 4,888 ft.

Texas Co.'s No. 4-B Polk, 750 ft. S and 1,450 ft. W from NE cor. of lease, Jacob Beaumont Sur.
Location.

Texas Co.'s No. 5-B Polk, 750 ft. S and 850 ft. W from NE cor. of lease, Jacob Beaumont Sur.
Location.

Texas Co.'s No. 6-B Polk, 750 ft. S and 250 ft. W from NE cor. of lease, Jacob Beaumont Sur.
Location.

LIVINGSTON—POLK COUNTY

C. & C. Drlg. Co. et al's No. 1 E. A. Watts, 330 ft. NS line, and midway between E and W lines of 124-ac. tract, A. Viesca Sur.
Location.

Gem Oil Co.'s No. 6 Davis & Holmes, 663 ft. from W and 662 ft. from N line of survey, A. Viesca Sur.
Rig up.

Werby and Refugio Oil Corp.'s No. 5 Dick & Failing, 330 ft. E of W line of tract, 550 ft. N of No. 1, A. Viesca Sur.
Location.

J. Z. Werby and Shell Pet. Corp.'s No. 4 Dick & Failing, 660 ft. NW of No. 3, 660 ft. from W line, A. Viesca Sur.
T.D. 4,259 ft.; cmtd. csg.

GRETA—REFUGIO COUNTY

Hewitt & Daugherty, 466 ft. from N line, 506 ft. from E line of Hardwick Sur.
Derrick.

Hewitt & Daugherty's No. 12 Lambert.
Rig up.

Humble O. & R. Co.'s No. 19 Heard, 466 ft. from N line, 466 ft. from W line of John Peoples Sur.
10¾-in. csg. at 1,211 ft.; drlg. shale 2,020 ft.

Humble O. & S. Co.'s No. 1 Marberry, 4,558 ft. from S line, 466 ft. from W line of John Denn Sur.
Drlg. sand and boulders 273 ft.

Stanolind O. & G. Co.'s No. 5 O'Connor.
Derrick.

Standard Oil Co. of Kansas.
Spudded.

REFUGIO—REFUGIO COUNTY

Houston Oil Co.'s No. 18 F. B. Rooke, 331 ft. E of W line, 330 ft. S from N line of 200-ac. lease.
Set screen and liner 4,925 ft.; I.P. 17 bbls. per hr. through ¼-in. choke.

Houston Oil Co.'s No. 19 P. H. Rooke, 66 ft. N of No. 18 P. H. Rooke.
T.D. 4,900 ft.; I.P. 25 bbls. per hr. through ¼-in. choke.

Houston Oil Co.'s No. 20 P. H. Rooke, 961 ft. NE of SW line, 137 ft. E of No. 18
7-in. csg. at 4,900 ft.; T.D. 4,906 ft.

Houston Oil Co.'s No. 21 P. H. Rooke, Thomas Mullen grant, 990 ft. from E line, 697 ft. SW from No. 18.
Drlg. shale 3,600 ft.

United Gas Co.'s No. 16 Lambert.
Drlg. sandy shale 3,793 ft.

United Gas Co.'s No. 18 Lambert.
Drlg. sandy shale 2,815 ft.

United Gas Co.'s No. 19 Lambert.
Drlg. plug 1,236 ft.

United Gas Co.'s No. 17 Lambert.
Drlg. sand 3,473 ft.

COLLETTO CREEK—VICTORIA COUNTY

American Liberty Oil Co.'s No. 2 Prybil, S of No. 1.
Rig up.

Albert Plummer's No. 4 Terrell.
T.D. 2,804 ft.; I.P. 275 bbls. daily.

Cox & Hooper's No. 2 Zimmer, 330 ft. from NW and SW lines of 125-ac. tract, Manchola Sur.
Drlg. 1,310 ft.

Houston Oil Co.'s No. 22 P. H. Rooke, 660 ft. from No. 19, 690 ft. from No. 20.
Derrick.

Houston Oil Co.'s No. 23 Rooke, 660 ft. W of No. 19.
Location.

McFADDIN-O'CONNOR DISTRICTS—VICTORIA AND REFUGIO COUNTIES

Sun Oil Co.'s No. 12 Janner.
Running csg. 1,580 ft.

Texas Co.'s No. 9 McFaddin.
Location.

LOUISE—WHARTON COUNTY

Pure Oil Co.'s No. 1 John Macha, 318 ft from NW line and from SE line of F. Walnut Sur., and 467 ft. from NE line of 101.53-ac. lease, M.&C. Sur. No. 25.
Derrick.

Pure Oil Co.'s No. 1 G. Wharton Est., 1,497 ft. from SW line and 318 ft. from SE line of F. Walnut Sur., Abst. A-35.
T.D. 6,510 ft.; P.B. to 2,893 ft.

Pure Oil Co.'s No. 2 Stewart, Morris & Cummings Sur., Sec. 25, 990 ft. out of SW cor. of 160 acres.
T.D. 5,141 ft.; I.P. 4 bbls. in 22 hrs.; tubing pressure 1,765 lbs.; csg. pressure 1,614 lbs.

Pure Oil Co.'s No. 3 Stewart, 1,000 ft. SW and 318.25 ft. SE from N cor. of W. L. Stewart's 160-ac. tract, Morris and Cummings Sur. No. 25.
Location.

Pure Oil Co.'s No. 4 Stewart, 485 ft. SW, 330 ft. NW of E cor. of W. L. Stewart's 160-ac. tract, Morris and Cummings Sur No. 25.
Drlg. shale 2,779 ft.

BAY ST. ELANE—TERREBONNE PARISH

Texas Co.'s No. 9 Bay St. Elane.
Making D.S. test at 6,348 ft.

CALLIOU ISLAND—TERREBONNE PARISH

Texas Co.'s No. 17 Calliou Island, Sec. 20-23-23.
Rig up.

Texas Co.'s No. 18 Calliou Island.
Drlg. hard sandy shale 4,147 ft.

SOUTH LOUISIANA FIELDS

BLACK BAYOU—CAMERON PARISH

Shell Pet. Corp.'s No. 21 Watkins, 1,570 ft. E of NW cor. Sec. 17-12s-13w.
Rig up.

Shell Pet. Corp.'s No. 3 State.
T.D. 6,216 ft.; cmtd. csg. from 6,110-15 ft.

BOSCO—ACADIA AND ST. LANDRY PARISHES

Superior Oil Prod. Co.'s No. 2 Malancon, 2,665 ft. S, 1,757 ft. W of NE cor. of Sec. 33-8s-3e.
Drlg. shale 6,050 ft.

Superior Oil Prod. Co.'s No. 1 Iseringhauser, 1,395 ft. E, 330 ft. N of SW cor. of N½ of NW¼ of Sec. 35-8s-3e.
Drlg. sand and shale 4,308 ft.

Superior Oil Prod. Co.'s No. 6 Hermandez, 1,900 ft. S and 643 ft. E of NW cor. of Sec. 34-8s-3e.
Drlg. shale 7,649 ft.

Superior Oil Prod. Co.'s No. 2 Falls, 330 ft. N, 1,796 ft. W of SE cor. of Sec. 27-8s-3e.
13⅜-in. csg. at 1,235 ft.
Drlg. shale and sand 6,021 ft.

Superior Oil Prod. Co.'s No. 5 Comeaux, 2,878 ft. S, 1,062 ft. W of NE cor. Sec. 34-8s-3e.
T.D. 8,711 ft.; reaming to set csg.

Superior Oil Prod. Co.'s No. 3 Arceneaux, 1,271 ft. S, 1,580 ft. W of NE cor. Sec. 33-8s-3e.
Drlg. shale 3,328 ft.

Superior Oil Prod. Co.'s No. 2 Johnson, 1,128 ft. N, 673 ft. E from SW cor. of NE¼ Sec. 34.
Cored oil sand from 8,642-52 ft.

Superior Oil Prod. Co.'s No. 1 Moise LaVergne, 269.7 ft. W and 98 ft. N of SE cor. of Sec. 28-8s-3e.
Drlg. sand 8,441 ft.

DARROW—ASCENSION PARISH

Humble O. & R. Co.'s No. 5 Community, 228 ft. SW of NE line of section, 200 ft. at R/A to east bank of river, Sec. 33-10s-2e.
20-in. csg. 252 ft.; T.D. 255 ft.

Humble O. & R. Co.'s No. 4 Community, 4,825 ft. from NE cor. and 288 ft. S of N line at R/A, Sec. 33-10s-2w.
Digging cellar.

CAMERON MEADOWS—CAMERON PAR.

Burton-Sutton Oil Co.'s No. 4 School Land, 2,891 ft. W and 150 ft. N of SE cor. of Sec. 16-4s13w.
Derrick.

Magnolia Pet. Co.'s No. 11 Cameron Meadows.
Location.

Texas Co.'s No. 1 Miami Corp.
Drlg. shale 9,235 ft.

Texas Oil Co.'s No. 11 Calcasieu Lake.
Rig up.

CHOCTAW DOME—IBERVILLE PARISH

Standard Oil Co.'s No. 5 Gay, 2,450 ft. S and 425 ft. E of NW cor. of NE Sec. 32-9s-11e.
Drlg. wtr. sand 3,192 ft.

DOG LAKE—TERREBONNE PARISH

Texas Co.'s No. 11 State, 150 ft. N and 2,474 ft. W, SE cor. Sec. 31-21s-16e.
Derrick.

GARDEN ISLAND BAY—TERREBONNE PARISH

Texas Co.'s No. 13 State, 3,391 ft. S and 1,504 ft. W of NE cor. Sec. 107-23-32.
Rig up.

GUEYDAN—VERMILLION PARISH

Pure Oil Co.'s No. 6, Alliance Trust, 667 ft E. 1,787 ft. S line of lease, Sec. 34-11s-1w
Sidetracked at 8,291 ft.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 4 Hanzen, 1,650 ft. W and 730 ft. N of SE cor. Sec. 11-12s-10w
Drlg. hard sandy shale 7,160 ft.

Calcasieu Oil Co.'s No. 3 H. C. Hanzen, 150 ft. S and 150 ft. E of NW cor. of lease Sec. 13-12s-10w.
Abd. 6,061 ft.; salt.

Gulf Prod. Co.'s No. 17 Erwin.
Drlg. shale 5,408 ft.

Gulf Prod. Co.'s No. 14-B State, 610 ft. S, 1,866 ft. E of NE cor. Sec. 13-12s-10w.
Derrick.

Sutton Oil Co.'s No. 1 Ellender, 616 ft. S and 50 ft. E of NW cor. SW¼ SE¼ Sec. 22-12s-10w.
T.D. 3,231 ft.; cmtd. csg.

Sutton Oil Co.'s No. 2 Portier, 717 ft. S and 50 ft. W of NW cor. SW¼ SE¼ Sec. 22-12s-10w.
Location.

Texas Co.'s No. 14 State, 500 ft. SE of No. 13, Sec. 13-12s-10w.
Derrick.

Yount Lee Oil Co.'s No. 1-A Gulf Land, 2,000 ft. S and 50 ft. E of the NW cor of Sec. 22-12-10.
Rig up.

NEW IBERIA—IBERIA PARISH

Harrison & Abercrombie's No. 3 Schwing, 500 ft. N and 50 ft. E of No. 2, Sec. 24-12s-5w.
T.D. 6,505 ft.; to P.B.

Iberia Oil Corp. and Y. D. Spell's No. 2 Bernard, 150 ft. E of No. 1, Sec. 54-12s-7e.
S.D. 3,846 ft.; salt.

Iberia Oil Co. and Y. D. Spell's No. 3 Bernard, 300 ft. N of No. 2, Sec. 54-12s-7e.
Drlg. sand 3,190 ft.

Texas Co.'s No. 1 Hanzen, NE along NW line of lease 508 ft., thence 150 ft. E at R/A, Sec. 54-12s-7e.
Reaming; T.D. 7,834 ft.

IOWA—CALCASIEU AND JEFF DAVIS

Shell Pet. Corp.'s No. 2 Ardoin.
Redrlg. hole 7,028 ft.

Shell Pet. Corp.'s No. 13 Hyde, 990 ft. S, 330 ft. E of NW cor. NE Sec. 13-9s-7w.
T.D. 7,008 ft.; I.P. 340 bbls. per day through various chokes; tubing pressure 1,225 lbs.; csg. pressure 865 lbs.

Shell Pet. Corp.'s No. 6 Stafford, 1,650 ft. from S line, 330 ft. W of NE cor. of lease. Sec. 18-9s-6w.
T.D. 6,783 ft.; 7-in. csg. 6,764-81 ft.; I.P. 686 bbls. per day through ¼-in. choke; tubing pressure 1,125 lbs.; csg. pressure 1,140 lbs.

Shell Pet. Corp.'s No. 14 Heyd, 330 ft. N, 1,819 ft. W of SE cor. of NE¼ Sec. 13.
T.D. 6,702 ft.; 7-in. csg. 6,623 ft.

JENNINGS—ACADIA PARISH

Simon-Tolson and Gardner's No. 1, 1,020 ft. due E and 250 ft. due W of SE cor. Sec. 46-9s-2w.
Abd. 1,870 ft.

Yount Lee Oil Co.'s No. 14 Housierre-Latrielle, 260 ft. N of No. 13, Sec. 47-9s-2w.
Drlg. sand 7,560 ft.

Yount Lee Oil Co.'s No. 10 Housierre-Latrielle, 5,435 ft. due E, 1,070 ft. due N of SW cor. of section.
Pulling tubing 7,805 ft.

LAKE BARRE—TERREBONNE PARISH

Texas Co.'s No. 31 Lake Barre.
T.D. 3,518 ft.; I.P. 660 bbls. per day.

Texas Co.'s No. 14 Lake Barre.
D.S. stuck 2,999 ft.; P.B. and sidetracked; Drlg. lime 2,910 ft.

Texas Co.'s No. 15 Lake Barre.
Drlg. shale 3,473 ft.

LAKE PELTO—TERREBONNE PARISH

Texas Co.'s No. 12 Lake Pelto.
Drlg. shale 6,700 ft.

Whitstone O. & G. Co.'s No. 1 Buckley, 300 ft. S and E of NW cor. SW SW Sec. 35-19s-16e.
T.D. 3,390 ft.; P.B. to 3,053 ft.; bailing.

LAKE HERMITAGE—PLAQUEMINES PARISH

Humble O. & R. Co.'s No. 3 Lafourche Levee Basin 1,725.
Location.

LAKE WASHINGTON—PLAQUEMINES PARISH

Humble O. & R. Co.'s No. 23 Cockrell-Moran, 650 ft. N and 21 deg. 30 min. E of No. 2 in Twp. 20s-26e.
Drlg. shale 2,682 ft.

LEESVILLE—LAFOURCHE PARISH

Gulf Prod. Co.'s No. 10 Bernard, 1,833 ft. E, 958 ft. S of NW cor. Sec. 26-21s-22e.
Derrick.

Emerald Pet. Co.'s No. 10 State, west bank, 300 ft. S of well No. 1.
Location.

Emerald Pet. Co.'s No. 11 State, east bank. 227 ft. N of well No. 1.
Location.

Emerald Pet. Co.'s No. 12 State, east bank. 250 ft. S of well No. 1.
Location.

Lincoln Oil Co.'s No. 5 State.
Location.

Texas Co.'s No. 31 Leesville.
D.S. stuck 3,619 ft.; washing over.

Texas Co.'s No. 23 Leesville.
10-in. csg. 838 ft.

Texas Co.'s No. 27 Leesville.
Bldg. derrick.

Texas Co.'s No. 30 Leesville, 1,075 ft. S, 310 ft. E. NW cor. Lot 6, Sec. 26-21s-22w
T.D. 4,361 ft.; P.B. and drilled to 3,669 ft.; put on air lift.

Union Sulphur Co.'s No. 6 Moss, located between No. 2 and No. 5 (W.O.).
Cutting and pulling liner 6,647 ft.

LOCKPORT—CALCASIEU PARISH

Magnolia Pet. Co.'s No. 5-A Farquar (W.O.).
Abd. 6,777 ft.

Magnolia Pet. Co.'s No. 8 Farquar (W.O.).
T.D. 6,722 ft.; I.P. 822 bbls. per day.

Magnolia Pet. Co.'s No. 7 Farquar (W.O.).
Drlg. shale 5,325 ft.

Magnolia Pet. Co.'s No. 14 Miller (W.O.).
T.D. 4,389 ft.

PORT BARRE—ST. LANDRY PARISH

Gulf Prod. Co.'s No. 11 Wilson Cochran, 1,500 ft. S, 9 deg., 6 min. W from most southerly NE cor. of Texas Co.'s Botnay Bay lease, Sec. 4-6s-5e.
Drlg. cap rock 3,508 ft.

ROANOKE—JEFFERSON DAVIS PARISH

Humble O. & R. Co.'s No. 2-B Devilbiss, 1,127 ft. W of No. 1-B, 440 ft. S of N line of S½ of Sec. 11-9s-4w.
Rig up.

Humble O. & R. Co.'s No. 1 Clayton, 2,080 ft. S and 440 ft. W, NE cor. Sec. 10-9s-4w.
Rig up.

Humble O. & R. Co.'s No. 3 Devilbiss, 1,399 ft W. 466 ft. S of NE cor. Sec 14-9s-4w
T.D. 9,216 ft.; perforated csg. from 9,198-9,203 ft.; tested S.W.

Shell Pet. Corp.'s No. 1 Jarnigan, 330 ft. W. 660 ft. S. NW cor. Sec. 12-9s-4w.
D.S. stuck; T.D. 10,001 ft.; P.B. to 8,930 ft.; to perforate csg.; milling at 8,750 ft.

Shell Pet. Corp.'s No. 1 Carter, 660 ft. N and 330 ft. W of SE cor. NW Sec. 1-9s-4w.
T.D. 8,697 ft.; I.P. 757 bbls. per day through ¼-in. choke; tubing pressure 1,145 lbs.; csg. pressure 1,190 lbs.

Shell Pet. Corp.'s No. 3 Kratzer, 1,320 ft. E and 440 ft. N of SW cor. of lease.
Cmtd. csg. 2,763 ft.

STARKS—CALCASIEU PARISH

Gulf Prod. Co.'s No. 33 Lutcher Moore, Sec. 19-9s-8w.
Drlg. salt 3,288 ft.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 12 Yount Lee Oil Co., 800 ft. S of No. 11, in line with Nos. 9 and 11, Sec. 12-13s-3w.
Fishing 8,196 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 1 Noble (W.O.).
Drlg. sandy shale 5,639 ft.

Union Sulphur Co.'s No. 724 fee.
Abd. 4,170 ft.

Union Sulphur Co.'s No. 807 fee.
Coring sand showing oil 2,892 ft.

Union Sulphur Co.'s No. 790 fee, 929 ft. S and 802 ft. W of C Sec. 29-9s-10w.
Abd. 5,072 ft.

Union Sulphur Co.'s No. 3 Kelly.
Rig up.

Union Sulphur Co.'s No. 809 fee.
Drlg. gumbo 103 ft.

WHITE CASTLE—IBERVILLE PARISH

Shell Pet. Corp.'s No. 1 White Castle Shingle Co., 1,830 ft. W, 100 ft. S from NE cor of lease.
Drlg. salt 6,072 ft.

Shell Pet. Corp.'s No. 1 Adams, 2,340 ft. N, 100 ft. E of SW cor. of lease.
Drlg. shale 4,944 ft.

MISCELLANEOUS WILDCATS

TEXAS

AUSTIN COUNTY

Arkansas Fuel Oil Co.'s No. 1 Herman W. Peschel, 990 ft. out of N cor. of 167.5-ac. tract, R. Stolze Sur.
Location.

BRAZORIA COUNTY

Amerada Pet. Corp.'s No. 1 Houston Farm Dev. Co., 1,414 ft. N, 316 ft. W of SE cor. of L. Bachelder Sur.
Ran 302 ft. of 7-in. liner; D.S. stuck; prepare to wash over fish; T.D. 6,992 ft.; milling at 6,626 ft.

George Strake's No. 2 Truska, 991 ft. W of No. 1, H.T.&B. Sur., Sec. 7.
S.D. 6,000 ft.

Holt et al's No. 1 Griffith, J. B. Bailey Sur
T.D. 4,200 ft.; waiting orders.

Showers & Moncrief's No. 1 Hughey, 5,500 ft. NW of discovery well, in center of Lot 18, H.T.&B. Sur., Sec. 29, Abst. 293.
Location.

Texas Co.'s No. 1 Freeport Sulphur Co., 2,764 ft. N, 1 deg., 40 ft. W and 1,184 ft. S, 88 deg., 20 ft. W of NW cor. of S. F. Austin Sur., Abst. No. 35, being in the Conception Areola Sur.
20-in. at 230 ft.; T.D. 252 ft.

CALHOUN COUNTY

Continental Oil Co.'s No. 2 American National Realty Co., 660 ft. from NW line, 660 ft. from NE line of Sec. 6, Blk. C, Pedro Garcia Sur.
Derrick.

Steinberger Pet. Co.'s No. 1 W. A. Shofner, 330 ft. from S and E lines of 100-ac. tract in M. Sanches Sur.
Cored sand showing gas and distillate from 6,137-51 ft.; coring ahead.

CHAMBERS COUNTY

Humble O. & R. Co.'s No. 1 Middleton, 468 ft. each way out of the SW cor. of survey.
7,088 ft.; flowed 646 bbls. in 20 hrs. through ¾-in. choke; tubing pressure 800 lbs.; csg. pressure 2,350 lbs.

South Gulf Oil Co.'s No. 1 J. T. White, Luke Brian Sur., 460 ft. from N line, 460 ft. from W line of 47.9-ac. tract.
Rig up.

Sun Oil Co.'s No. 1 Hamilton, 1,400 ft. from N line, 1,400 ft. from W line of survey T.&N.O. Sur., Sec. 128.
Abd.; T.D. 9,055 ft.

FORT BEND COUNTY

W. A. Shafer et al's No. 1 V. B. Bortaah, 693 ft. SW of NE line and 1,003 ft. NW of SE line of Sec. 52, H.&T.C. Sur.
S.D. 2,900 ft.

Turnbull & Irwin's No. 1 Herman Hospital, 100 ft. W of E line, 350 ft. N of SL of 446-ac. tract, J. H. Cartwright Sur.
Drlg. shale and lime 5,803 ft.

George White et al's No. 1 M. M. Cravins, 1,000 ft. from N, 300 ft. W of SW cor of survey, B.B.B.&C. Sur. No. 8.
Rig up.

GALVESTON COUNTY

Gillock Pet. Co.'s No. 2 Maco Stewart, 900 ft. N and 150 ft. W of No. 1, Alex Farmer Sur.
T.D. 1,500 ft.; waiting on surface pipe.
S.D.

GRIMES COUNTY

Anderson & Kerr Drlg. Co.'s No. 1 R. Lueders, 500 ft. S of N line, 1,200 ft. E of W line of 320-ac. tract and survey, Blake Brantley Sur., 2½ miles SW of Plantersville.
Location.

Hubert Holt et al's No. 1 Simon Fuqua 1,200 ft. N of S line and 400 ft. W of E line of 177-ac. lease and survey, Moses Evans Sur.
S.D. 2,080 ft.

Dr. Marshall et al's No. 1-B Todd, 300 ft from E line and 175 ft. from N line of 150-ac. tract in extreme NW cor. of county (25 ft. N of No. 1).
S.D. 2,005 ft.

Roan et al's No. 1 S. W. Sealy, 3,474 ft. N of S line and 850 ft. E of W line of survey, B. F. Smith Sur., 2 miles SW of Kellum Springs.
S.D. 2,650 ft.

HARDIN COUNTY

Frazier & Greer's No. 1 Sternberger Lbr Co., 1,325 ft. S and 400 ft. W of the NE cor. of a 115-ac. tract, J. Pearson Sur.
Derrick.

HARRIS COUNTY

Eureka Heights' No. 1 Varner, 400 ft. from S line of 107.23-ac. tract and 4,173 ft. from E line of H. Rinerman Sur.
Drlg. shale 7,311 ft.

T. S. F. Oil Co.'s No. 1 J. B. Hine, Arthu McCormick Sur., Abst. 46.
T.D. 3,525 ft.; 7-in. csg. 3,503 ft.; prepare T.D. 3,525 ft.; 7-in. csg. 3,503 ft.; flowed wtr. with brackish taste; S.D.

C. C. Foster et al's No. 1 H. K. Johnson 2,000 ft. from S line and C of E and W lines of G.C.&S.F. Sur.
Drilled 25 ft. and S.D.

Johnston & Johnston's No. 1 Fee land, 330 ft. S, 300 ft. E of NW cor. of 20-ac. tract, Sur., Sec. No. 5.
Moving in rig.

Hill & Hill's No. 1 Wharton, 466 ft. from NW cor. Sec. 5, W C.R.R. Sur.
Drlg. shale and sand streaks 7,023 ft.

W. U. Paul's No. 2 House, 100 ft N of No 1, M. Magruder Sur.
Drlg. shale 7,695 ft.

HOUSTON COUNTY

Adams et al's No. 1 Sanders, 330 ft. from S line, 330 ft. from W line of 55-ac. tract of lease, J. Thomas Sur.
T.D. 2,850 ft.; to make electrical coring test.

JACKSON COUNTY

A. M. Harris' No. 1 Whitley, 800 ft. out o' SE cor. of F. G. Keller Sur.
Location.

Shell Pet. Corp.'s No. 1 W. W. McCrary 460 ft. out of SE cor. of 50-ac. tract, A Kountze Sur.
T.D. 4,121 ft.; hard sand; reamed from 3,830-4,026 ft.

JASPER COUNTY

Republic Prod. Co. and Houston Oil Co.'s No. 1 Sabine Tram. Co., 330 ft. out of NW cor. Sec. 71, H.&T.C. Sur.
Drlg. shale 3,720 ft.

JEFFERSON COUNTY

Sun Oil Co.'s No. 1 H. Long, 1,500 ft. l line, 990 ft. E line of lease.
Abd. 9,045 ft.

Sun Oil Co.'s No. 1 Hebert & Braussard, 6, 890 ft. NW along SW line and 660 ft. NE at right angles to SW line, B. Blackman Sur., Abst. No. 2.
Rig up.

LAVCA COUNTY

L. A. Douglas' No. 1 Fehrenkamp, 600 ft. from W line, 720 ft. from N line of Mitchell Sur.
Location.

LIBERTY COUNTY

R. M. Bruner et al's No. 1 N. Bell, 150 f from N line and 150 ft. from W line of Bell's 187-ac. tract, H.&T.B. Sur. No
Rigging up.

Extension Oil Co.'s No. 1 J. A. Lovett, 2 ft. from E and 600 ft. from S line of lease P. P. Deevers Sur.
S.D. 4,048 ft.

J. W. Frazier et al's No. 2 Lynott & Buffum, 466 ft. from N and E lines of 60-ac. tract in extreme SE part of survey James Robeson Sur.
Clearing location.

Liberty-Independent Oil Co.'s No. 1 J. M Neal, 3,550 varas from E line and 56 varas from N line of Samuel Strong Sur
S.D. 3,820 ft.

A. L. Maxwell's No. 1 M. P. Hinchliff, 20 ft. from E line and 1,000 ft. from the N line of survey. H.&T.C. Sur., Sec. 10a.
Waiting on csg. 580 ft.

Thomas et al's No. 1-A Eicke, 660 ft. from W line and 2,350 ft. from S line of tract in Green Sur.
T.D. 5,047 ft.; 6¾-in. csg. at 5,029 ft.

MADISON COUNTY

Madisonville Pet. Co.'s No. 1 Cannon, 660 ft. N of S line, 440 ft. E of W line of 185-ac. tract, J. V. Phillips Sur.
Location.

MATAGORDA COUNTY

Cockburn Oil Co.'s No. 7 Hawkins, 150 ft. NW of No. 6 Hawkins Sur., D. McCarthy Sur.
Rig up.

Dr. Griffith's No. 1 fee, 3,000 ft. from line and 3,000 ft. from W line of Wm. H Bell Sur.
Rigging up and S.D.

Horace M. Smith, Inc.'s No. 1 Wadsworth ranch, 150 ft. out of S cor. of Lot No. Blk. S. R. Fisher Sur.
T.D. 6,161 ft.; D.S. stuck 375 ft. off bottom; shot D.S. off and will run 9⅝-in. csg. for a screen test after hole as junk is sidetracked.

MONTGOMERY COUNTY

Travis Baker et al's No. 1 Foster Estate, 1,200 ft. E of W line and 700 ft. S of N line of Blk. No. 50, J. M. De La Garza Sur.
Derrick.

Reynolds Drlg. Co. et al's No. 1 Mrs. Clara B. Stewart, 330 ft. S and E of most easterly inner cor. of 595-ac. tract, John Cor ner Sur.
S.D. 5,500 ft.

Trans State Oil Co.'s No. 1 Foster, 700 ft. E of W line, 2,000 ft. N of S line, Lot 37.
Drlg. shale 2,720 ft.

Woodard-Smith-Cooper's No. 1 J. V. Scott F. A. B. Wheeler Sur.
Drilled plug to core ahead.

ORANGE COUNTY

Blue Line Oil Co.'s No. 1 Godwin, Richard Ballew Sur., 300 ft. from E line and 150 ft. from NE line of Godwin 20-ac. tract
S.D. 2,770 ft.

Ellis Oil Co.'s No. 1 G. W. Pell, 100 ft. from N and 300 ft. from W line of Pell tract in the J. M. Henerie Sur.
Drlg. shale 1,826 ft.

POLK COUNTY

Howard Dailey et al's No. 1 Z. B. Knox 1,450 ft. W and 1,920 ft. S of NE cor of F. Chairs Sur., 16 miles NE of Corrigan.
S.D. 60 ft.

J. F. Anderson's No. 1 E. L. Duke (O.W.D D.), 400 ft. from E and 350 ft. from S of SW cor. of P. Michelick 50-ac. lease, Abst 59, P. J. Mineral Sur.
Waiting on a new mud pump; T.D. 5,30 ft.

Kirby Pet. Co.'s No. 1 Kirby Lbr. Co., 1,-200 ft. N, 40 deg. W from NE cor. of Geo. Loving Sur., Abstract 402, thence 330 ft. NE at R/A T. F. Pickney Sur.
Spudded 60 ft. and S.D.; to finish R.U.

J. W. Leggett et al's No. 1 Bergman, C of 294-ac. tract, or 1,100 ft. W of H.E.&W.T. R.R., J. T. Pinkney Sur.
Rig up.

Dick Schwab's No. 1 Lynch, 330 ft. out of NW cor. of 200-ac. tract in the George Jameson Sur.
Location.

E. A. Thompson's No. 1 Haynes, 990 ft. out of NW cor. of 320-ac. tract and survey, J. Whitmire Sur., E of Leggett.
S.D. 1,905 ft.

REFUGIO COUNTY

Cecil Hagen et al's No. 1 Edith Clarkson, 1,736 ft. from N line, 3,820 ft. from E line of J. Coughlin Sur.
Location.

Magnolia Pet. Co.'s No. 1 Woods, 330 ft. from S and W lines of S. Turner Sur.
Drlg. shale 3,565 ft.

SAN AUGUSTINE COUNTY

Fidelity Exploration Co.'s No. 2 Bryan & Flournoy, 400 ft. from No. 1.
T.D. 1,565 ft.

SAN JACINTO COUNTY

Ralph Sturam et al's No. 1 R. B. Love et al, 475 ft. S of N line and 2,000 ft. W of E line of 177-ac. tract, Drury McGee Sur.
Moving in rig.

TRINITY COUNTY

Boone Bros.' No. 1-C Texas Long Leaf Lbr. Co., C of 80-ac. tract, Martinez Sur.
Lost hole 1,230 ft.; skidded 14 ft. west; Drlg. shale 2,550 ft.

VICTORIA COUNTY

A. I. Ahern's No. 1 Henderson & Pickering, 5,280 ft. from NW line, 330 ft. from NE line of W. M. Rupley Sur.
Drlg. 3,550 ft.

WALKER COUNTY

Boone Bros.' No. 1-D Texas Long Leaf Lbr. Co., 330 ft. E and 275 ft. N of SW cor. of 112.6-ac. tract, Mary Milsap Sur.
Rig up.

S. E. Gray's No. 1 Winzell, 1,200 ft. N and 1,000 ft. E of most southerly S line of survey.
10¾-in. csg. at 145 ft.

WALLER COUNTY

Smith et al's No. 1 J. S. Garrett, 4,840 ft. NW and 325 ft. NE from SE cor. of S. M. Williams Sur., 3 miles N of San Felipe.
Drlg. shale 4,520 ft.

WASHINGTON COUNTY

Arkansas Fuel Oil Co.'s No. 1 Witschark, 100 ft. NW of Bruton, 100 ft. S of the center of a 65-ac. tract, J. D. Miller Sur.
Drlg. shale 3,900 ft.

WHARTON COUNTY

John Deering's No. 1 C. T. and D. Kountze, 1,320 ft. from N line, 330 ft. from E line of S.A.&M.G. Sur., Sec. 1, Abst. 328.
Abd. 6,730 ft.

Texas Co.'s No. 1 Pierce Estate, 4,850 ft. S, 34 deg. E and 4,300 ft. N, 56 deg. E from W cor. of Tract 2, I.&G.N. Sur. No. 38.
Drlg. sand and shale 4,610 ft.

SOUTH LOUISIANA
ACADIA PARISH

Humble O. & R. Co.'s No. 1 American Rice Mills, 660 ft. S and 1,320 ft. W from NE cor. Sec. 27-10s-1e.
Reaming 3,964 ft.

Superior Oil Co. et al's No. 1 A. S. Newman, 2,000 ft. N and 1,120 ft. E of SW cor. Sec. 24-7s-1w.
Drlg. shale 6,586 ft.

AVOYELLES PARISH

Bell Drlg. Co.'s No. 2 Thompson, 450 ft. S, 860 ft. E, NW cor. NE¼ Sec. 11-2n-5e.
Rig up and S.D.

Southern State Pet. Co.'s No. 1 Boyette, 330 ft. N and 330 ft. E of SW cor. Sec. 28-3n-5e.
S.D. 3,427 ft.

BEAUREGARD PARISH

Chew & Kirby's No. 1 Long Bell Lbr. Co., 330 ft. S and W of C of NE¼ Sec. 26-2s-8w.
Spudded.

Richardson & Martin's No. 1 Southwest Lbr. Location.

CALCASIEU PARISH

Fred Oil Co.'s No. 2 Faizst, 262 ft. E and 83 ft. S of NW cor. SE¼ Sec. 26-8s-10w.
Spudded and S.D.

Fohs Oil Co.'s No. 1 McIvor, 330 ft. S and W of NE cor. Sec. 14-9s-8w.
Location.

Fohs Oil Co.'s No. 2 Castle, located in C of NE¼ of SW¼ Sec. 14-9s-8w.
Drlg. hard lime 6,794 ft.

Fohs Oil Co.'s No. 3 Castle, 990 ft. due E of producer in SW¼ Sec. 13-9s-8w.
Drlg. sandy shale 6,980 ft.

Fohs Oil Co.'s No. 4 Castle, 330 ft. S and 330 ft. W of C Sec. 13-9s-8w.
Drlg. sandy shale 6,897 ft.

Gulf Prod. Co.'s No. 1 H. Starks et al, 1,650 ft. W and 1,980 ft. S of NE cor. Sec. 26-11s-12w.
Drlg. hard sand 8,573 ft.

Nicholas McCaleb's No. 1 Grey, 2,200 ft. S, 1,200 ft. E of NW cor. Sec. 22-8s-13w.
Reaming 615 ft.

Texas Co.'s No. 1 Nickerson, 3,139 ft. N and 3,238 ft. W of SE cor. Sec. 12-9s-8w.
T.D. 6,721 ft.; pulling screen to core deeper.

Union Sulphur Co.'s No. 3 State, 2,135 ft. S, 2,340 ft. E of NW cor. Sec. 12-9s-8w.
Location.

Union Sulphur Co.'s No. 1 Castle, 326 ft. N and E of NW Sec. 13-9s-8w.
Drlg. brittle shale 7,225 ft.

Union Sulphur Co.'s No. 1 Buhler, 1,485 ft. N and 425 ft. W of SE cor. Sec. 11-9s-8w.
Drlg. sand and shale 7,251 ft.

Union Sulphur Co.'s No. 2 Barbe, 396 ft. N and 329 ft. W of SE cor. of NE¼ Sec. 11-9s-8w.
Drlg. sand and lime 4,321 ft.

Union Sulphur Co.'s No. 1 Reeves-Mayo, 650 ft. NE of discovery.
Drlg. sand and gravel 718 ft.

Union Sulphur Co.'s No. 2 Castle, 660 ft. E of No. 1 Castle.
Drlg. wtr. sand 6,366 ft.

Wheeler Oil Co.'s No. 1 Gabbert, 1,322 ft. E and 548 ft. N of SW cor. of Sec. 28-9s-7w.
Drlg. shale 8,665 ft.

EAST FELICIANA PARISH

Thompson Creek Oil Co.'s No. 1 Fannie Noland, 2,600 ft. E and 1,580 ft. N of SW cor. Sec. 70.
Washing over stuck D.S.; T.D. 1,490 ft.

CAMERON PARISH

Texas Co.'s No. 1 Jessen, 1,170 ft. E and 550 ft. N of C Sec. 24-14s-10w.
Drlg. shale 9,010 ft.

JEFFERSON DAVIS PARISH

George W. Strake's No. 1 Calcasieu Natl. Bank, 200 ft. S and E of NW cor. SE NE Sec. 12-9s-6w.
T.D. 8,091 ft.; P.B. to 7,550 ft.; drilled to 8,502 ft.; P.B. to 7,918 ft.; to make D.S. test.

JEFFERSON PARISH

Lincoln Oil Co.'s No. 1 Rigaud, Sec. 28-21s-25e.
Drlg. shale 4,362 ft.

Texas Co.'s No. 1 Bayou St. Dennis, 20,907 ft. S, 4,853 ft. E of NW cor. of Twp., Sec. 19-17s-24e.
Drlg. shale and lime 7,656 ft.

LAFOURCHE PARISH

Southern Sulphur Corp.'s No. 1 D. L. Lagraize, 800 ft. E of NW cor. of Lot 7, thence 250 ft. S of Sec. 26-21s-22e.
Spudded and shut down.

PLAQUEMINES PARISH

Venice Corp.'s No. 1 Burras.
Drlg. lime 2,091 ft.

RAPIDES PARISH

J. B. Evers' No. 1 G. Wettermark, 540 ft. S and 520 ft. E, NW cor. NE SW Sec. 35-6n-2e.
Location.

C. D. Loe's No. 1 Barrett, 330 ft. NW of SE line and 880 ft. NE of SW line of Sec 40-5n-1w
S.D. 3,500 ft.

Williams-Terrell & Day's No. 1 Armstrong & Murphy, 286 ft. N and 300 ft. W of SE cor. Sec. 24-5n-1w.
Moving in rig.

ST. BERNARD PARISH

Danciger's No. 1 Battles, 836 ft. N, 2,198 ft. W of SE cor. Sec. 135-14s-14e.
Cmtd. csg.; moved off rig; T.D. 6,001 ft.

ST. MARTIN PARISH

Texas Co.'s No. 1 State-Plumb Bob, 3,107 ft. E and 2,154 ft. N of SW cor. Sec. 9-8s-7w.
20-in. csg. at 101 ft.; drlg. shale 3,199 ft.

TANGIPOHA PARISH

R. A. Conklin's No. 1 Lake Superior Piling Co., 200 ft. W and N of SE cor. Sec. 19-5s-9e.
Drlg. gumbo 910 ft.

VERMILLION PARISH

Moore Bros.' No. 1 Brussard, 350 ft. S of N line, 250 ft. E of W line, NE cor. Sec. 32-11s-3e.
S.D. 4,056 ft.

Kansas Wildcats

(Continued from Page 149)

N and W of C Sec. 26-17-9w.
Siliceous lime 3,177½-78 ft.; hole full oil.

Lario O. & G. Co.'s No. 1 Wright, SW SW NE Sec. 17-16-8w.
T.D. 1,994 ft.; U.R. 10-in. csg.

Lario O. & G. Co.'s No. 1 State, SW cor. Sec. 29-15-8w.
Rigging up.

Pryor & Lockhart's No. 1 Gregory, SE SE SE Sec. 19-16-8w.
Drlg. 2,100 ft.

Western Exploration Co.'s No. 1 Wilkins, NW SW NW Sec. 9-17-9w.
Location.

HARVEY COUNTY

O. J. Connell et al's No. 1 Roth, SW cor. Sec. 16-22-2w.
Spudded and S.D.

Wenzel et al's No. 1 Schrag, NW SE Sec. 24-22-3w.
T.D. 587 ft.; S.D. for csg.

MARION COUNTY

Youker et al's No. 1 Bernhardt, C SE NW Sec. 7-18-4.
Drlg. 2,325 ft.

McPHERSON COUNTY

Brosius et al's No. 1 Hanson, NE NE SW Sec. 15-17-2w
T.D. 1,108 ft.; fishing.

Carey & Miller's No. 1 Husband, SE SE NW Sec. 6-19-3w.
Moving in material.

Johnson & Carey et al's No. 1 Dyck, SE NE SE Sec. 35-22-5w.
Siliceous lime 4,064-70 ft.; H.F.W.

Lario O. & G. Co. et al's No. 1 Schreg, NW SE SW Sec. 22-19-4w.
Siliceous lime 3,880-89 ft., T.D.; dry and abd.

Lario O. & G. Co.'s No. 1 Base, SW cor. Sec. 22-20-2w.
Wilcox 3,495 ft.; H.F.W. 3,505-10 ft., T.D.; fishing.

Palmer Oil Corp.'s No. 1 Swenson, NE NE SW Sec. 11-18-3w.
Drlg. 1,930 ft.

L. W. Prunty et al's No. 1 Davis, NE cor. Sec. 6-22-1w.
Chat 2,922 ft.; drlg. 2,928 ft.

Shell Pet. Corp.'s No. 1 Wenger, NE cor. Sec. 2-20-1w.
Chat 2,906-46 ft.; show gas and wtr.

Stafford et al's No. 1 Krehbiel, NW NW SE Sec. 27-21-3w; (O.W.D.D.).
C.O. at 2,080 ft. and S.D.

NESS COUNTY

Phillips Pet. Co.'s No. 1 Young, C NW SW Sec. 13-18-21w.
Drlg. 2,374 ft.

Texas Co. and Gypsy Oil Co.'s No. 1 Goodman, C SW SW Sec. 21-19-23w.
Siliceous lime 4,788 ft.; drlg. 4,955 ft.

PAWNEE COUNTY

Atlantic Oil Prod. Co.'s No. 1 Slepake, C NE NE Sec. 15-23s-17w.
Moving in material.

RENO COUNTY

Bradley's No. 1 Olmsted, SW SW SW Sec. 22-22-7w.
Moving in material.

Foraker et al's No. 1 Hiett, SE SW NE Sec. 34-24-4w.
T.D. 1,285 ft.; S.D.

Kessler, Their and Skelly's No. 1 Bigger, NE SE SW Sec. 29-23-6w.
Siliceous 4,141-50 ft.; dry and abd.

Privett Drlg. Co.'s No. 1 Crotts, NE NW NE Sec. 27-26-10w.
Set 6-in. 3,741 ft.; drlg. 3,800 ft.

RICE COUNTY

Allison & Fitzwilliams et al's No. 1 Stumpa, NW NW SW Sec. 4-18-10w.
K.C. lime 2,950 ft.; drlg. 3,100 ft.

Bradley's No. 1 Olmstead, SW SW SW Sec. 22-22-7w.
Moving in material.

Day et al's No. 1 Mason, NW NE NE Sec. 28-21-7w.
Rig.

Day's No. 1 Mason, NW NE NE Sec. 28-21-7w.
Moving in material.

Foraker, Nickerson et al's No. 1 Lyons, SE NW Sec. 27-20-8w.
Drlg. 2,870 ft.

Gypsy Oil Co.'s No. 1 Koesling, NW NW SW Sec. 10-20-9w.
Set 5-in. csg. 3,240 ft.; Siliceous 3,239-61 ft.; est. 100 bbls.

Langston et al's No. 1 Markle, NE NE SW Sec. 1-20-9w.
Siliceous 3,415-20 ft., T.D.; H.F.W.; dry and abd.

Marathon Oil Co.'s No. 1 Grove, SE NE NW Sec. 29-19-9w.
Location.

Vickers Pet. Co. et al's No. 1 Gouldner, SE NE NW Sec. 16-18-9w.
15-in. csg. 135 ft.; drlg. 1,370 ft.

ROOKS COUNTY

Carman & Hershey's No. 1 Nelson, NW NW NE Sec. 27-10-16w.
Rig.

Carman & Hershey's No. 1 Nelson, NW NW NE Sec. 27-10-16w.
Rig.

Stearns & Streeter's No. 1 Hoskins, SE SW SE Sec. 34-9-16w.
Acidized; pumped 120 bbls. oil from Oswald lime 3,034-3,106 ft.; pumping 25 bbls. oil daily.

Trees Oil Co. and Findeiss' No. 1 Johnson, SW SW SE Sec. 26-10-19w.
Rig.

RUSH COUNTY

Lario O. & G. Co. and Phillips Pet. Co.'s No. 1 Benbow, NW NE NE Sec. 12-17-19w
K.C. lime 3,418 ft.; wtr. at 3,460-70 ft.; Drlg. 3,559 ft.

Morgan & Flynn's No. 1 Schlegel, SE SE NW Sec. 26-17-16w.
Drlg. 490 ft.

RUSSELL COUNTY

J. Brouk and R. D. Bailey's No. 1 Kluesener, NW SE Sec. 34-15-12w.
Rigged up.

Hartman & Blair's No. 1 Furthemyer, NE cor. Sec. 1-14-14w.
Oswald 3,008 ft.; drlg. 3,238 ft.

Hartman & Blair's No. 1 Garrett, SW SW NW Sec. 24-13-12w.
Moving in material.

Hartman & Blair's No. 1 Krause, NE NW NW Sec. 5-15-15w.
Conglomerate 3,410 ft.; H.F.W. at 3,468 ft.; T.D.; S.D.
Oswald and 6-in. csg. at 3,171 ft.; drlg. 3,204 ft.

Hartman & Blair's No. 1 Hildebrandt, NW NE SW Sec. 12-14-14w.
Drlg. 640 ft.

Lario O. & G. Co. et al's No. 1 Nuss, NW SW SW Sec. 11-16-14w.
Building rig.

Murphin et al's No. 1 Funk, SW cor. Sec. 19-12-13w.
Drlg. 2,025 ft.

Ryan Pet. Co.'s No. 1 Newbold, NW SE NE Sec. 25-12-15w.
Spudding.

Vernon & Murphin's No. 1 Becker, NE cor. Sec. 32-15-13w.
Rig.

Wolf Creek Oil Co.'s No. 1 Kraft, SW cor. Sec. 26-16-11w.
T.D. 735 ft.; running 12-in. csg.
Drlg. 1,560 ft.

Wolf Creek Oil Co. et al's No. 1 Penn Mutual, SW cor. Sec. 22-15-15w.
Rigging up.

SALINE COUNTY

Dieter et al's No. 1 Herrington, NE NW SE Sec. 3-13-1w.
U.R. 6-in. csg. at 3,020 ft.

SEDGWICK COUNTY

Allison & Fitzwilliams et al's No. 1 Struthers, NE SW Sec. 34-28-2w.
H.F.W. 3,176-87 ft.; T.D. 3,295 ft.; fishing.

Cameron, Derby Oil Co. and Trees' No. 1 Brainard, SW SE NW Sec. 19-24-2.
Spudded and S.D.

Magnolia Pet. Co.'s No. 1 Bartholomew, SE SE SW Sec. 30-27-4w.
Chat 3,682 ft.; 9-in. 3,692 ft.; standardizing.

SCOTT COUNTY

Atlantic Oil Prod. Co.'s No. 1 Mark "A," C SE SE Sec. 28-20-33w.
Location.

SHAWNEE COUNTY

Jim Edwards' No. 1 Detrick, C NW NE Sec. 21-14-15.
S.D. 630 ft.

STAFFORD COUNTY

Atlantic Oil Prod. Co.'s No. 1 Hohner, NW SE SE NE Sec. 31-23-14w.
Siliceous lime 4,076-85 ft.; 1,500 ft. of wtr. in hole; cored to 4,090 ft.; T.D.; abd.

Atlantic Oil Prod. Co. and Phillips Pet.

Co.'s No. 1 Guthrie, C NW NW Sec. 16-25-11w.
Siliceous lime 4,104-08 ft.; wtr.; abd.
Lario O. & G. Co.'s No. 1 Tudormorgan, SE SE NW Sec. 23-24-13w.
Drlg. 3,056 ft.

SUMNER COUNTY

T. Palmer's No. 1 Wentworth, NW NW NE Sec. 9-35-2.
Drlg. 3,475 ft.
Shell Pet. Corp.'s No. 1 Green, SE SW NW Sec. 3-33-2.
Drlg. 990 ft.
Wakefield Pet. Co. et al's No. 1 Newton, SE Sec. 21-30-2.
Rig.
D. J. Wilson et al's No. 1 Clark, 1,320 ft. from W and 25 ft. from S line of NW Sec. 15-35-1w.
Building rig.

TREGO COUNTY

Central Commercial's No. 1 Wagg, NW NW SE Sec. 17-13-21w.
T.D. 1,600 ft.; fishing.
Hansa & Lauck's No. 1 Lang, SE SE NW Sec. 1-14-21w.
Cellar.
Jenmar Oil Co.'s No. 1 Jones, SE cor. Sec. 20-12-23w.
Oswald lime 3,790 ft.; S.D. at 3,828 ft.

WOODSON COUNTY

Kite et al's No. 1 Gorman, NE NW Sec. 18-25-14e.
Drlg. 275 ft.

Oklahoma Wildcats

(Continued from Page 152)

PITTSBURG COUNTY

McAllister Pet. Corp. et al's No. 1 Chunn, C SE NW Sec. 29-4-14.
T.D. 1,530 ft.; pipe collapsed; S.D.
P. H. Gray et al's No. 1 Lee, NW SE Sec. 12-5-12.
Drlg. 1,150 ft.

PONTOTOC COUNTY

Anderson & Kerr's No. 1 Newburn, NW SW NE Sec. 24-5-3.
Rig.
E. M. Blanchard's No. 1 Crabtree, NE SE NE Sec. 27-3-6.
S.D. 2,920 ft.
Charles E. Carter's No. 1 Wood, NW SW SE Sec. 5-4-3.
S.D. 2,070 ft.
Crabtree's No. 1 Chandler, NE SE SW Sec. 4-5-6.
S.D. 150 ft.
Crabb-Craw Oil Co.'s No. 1-A Breco, SE NE SW Sec. 3-4-6.
Sand 1,106-18 ft.; pumped 10 bbls. in 24 hrs.; S.D.
Fleetborn Oil Corp.'s No. 1 Oliver, NE NW SE Sec. 21-4-5.
Rigged up.
C. W. James et al's No. 1 Neal, C NW SE SW Sec. 4-5-3.
Viola 3,798 ft.; Wilcox sand 4,175-4,212 ft.; H.F.W.; P.B. 4,112 ft.
Mudge O. & G. Co.'s No. 1 Clampett, SW NW NW Sec. 10-2-6.
S.D. 915 ft.
Paramount Oil Co.'s No. 1 Graham, SW SE SW Sec. 13-1-7
500 ft. wtr. in hole from second Bromide sand at 3,288-98 ft.; S.D. 3,345 ft.
Gillett & Kroeger's No. 1 Robbins, NE SE Sec. 31-1-4.
Machine.
Gillette & Kroeger's No. 1 Duver, NW SE Sec. 36-1n-6e.
S.D. 1,185 ft.
H. M. Marcum's No. 1 Magnuson, SW SE SE Sec. 23-2-7.
T.D. 1,930 ft.; H.F.W.; abd.
Southern Oil Co.'s No. 1 Walker, NW NW SW Sec. 11-4-6.
Sand 785-816 ft.; 8,000,000 ft. of gas; drlg. 920 ft.

POTTAWATOMIE COUNTY

Howard Sherman et al's No. 1 Wingo, NE NW SE Sec. 32-10-5.
Drlg. 2,230 ft.

SEMINOLE COUNTY

Ray Dorris and J. T. Hall's No. 1 Dorris, SE SE SW Sec. 31-10-7.
Sand 520-63 ft.; H.F.W.; S.D. 608 ft.
Crabtree Drlg. Co.'s No. 1 Chandler, NE SE SW Sec. 4-5-6.
S.D. 110 ft.
Verser & Clay et al's No. 1 Thomas, NE SE NW Sec. 1-6-6.
S.D. at 2,802 ft.
Wofford Drlg. Co. et al's No. 1 Abbott, NE cor. Sec. 33-8-7.
Rig only.
Wofford Drlg. Co. et al's No. 1 Thomas, NW SE Sec. 3-6-7.
Dolomite 3,890 ft.; T.D. 3,917 ft.; hole full oil; shut in for tanks.

TEXAS COUNTY (PANHANDLE)

Ben F. Ash et al's No. 1 Guymon Townsite, C NE SE Sec. 30-3n-15e; (Cimarron Meridian).
T.D. 2,420 ft.; fishing for drill pipe.

WASHITA COUNTY

Okla.-Midwestern Oil Co.'s No. 1 Dock, SW cor. Sec. 21-8-18w.
T.D. 2,430 ft.; lost tools in hole; rig rebuilt; S.D.
Anadarko Basin Oil Co.'s No. 1 Wolf, NE SW Sec. 23-9-17w.
Rigged up and S.D.

SOUTHERN OKLAHOMA
ATOKA COUNTY

Brookshire et al's No. 1 Rowland, NW NE NE Sec. 13-3-10.
H.F.W. 3,844 ft.; P.B. 757 ft.; treated with acid; C.O.
Malernee et al's No. 1 D. O. K. Land Co., C SE SE Sec. 36-2s-13.
S.D. 3,115 ft

BRYAN COUNTY

C. B. Welch's No. 1 Collins, NE NE Sec. 19-8s-8e.
Drlg. 455 ft. in lime.

COMANCHE COUNTY

H. W. Baker's No. 1 Miller, SE SW SE NE Sec. 22-2-13w.
S.D. 120 ft.
Oscar Jones' No. 1-A Sheetz, NE SW Sec. 26-3-10w.
Machine.
Henry Rosenthal et al's No. 1 Au-che-re-ah, NW NW NW Sec. 5-1n-9w.
Sand 1,479-93 ft.; hole full oil and wtr.; to bail.
F. F. Stevens' No. 1 Green, SE SW Sec. 2-1-13w.
Drlg. 1,437 ft.
Heiden & Taylor's No. 2 Crutcher, C NW Sec. 11-1n-12w.
S.D. at 860 ft.

CARTER COUNTY

Waco Turner's No. 1 Munson, NE NW NE Sec. 35-5s-2w.
Rigging up rotary.
Carter Oil Co.'s No. 1 Carter-Williams, SW NE SW Sec. 27-2s-3w (7,000-ft. test).
Drlg. 4,794 ft. in shale.

HARMON COUNTY

Jud Leath et al's No. 1 McConnell, NW cor. Sec. 22-3-24w.
Rigged up and S.D.
Wilson & Walker's No. 1 Wilhelm, SE cor. Sec. 30-4-24w.
Rigging up machine.

JACKSON COUNTY

Associated Oil Co.'s No. 1 Harrell, NE SW Sec. 13-1-21w.
Drlg. 1,195 ft.
J. G. Buel et al's No. 1 Kizziar, SE SE NE Sec. 2-2n-22w.
Drlg. 775 ft.
Burk Royalty Co.'s No. 1 Gore, SE NW SE Sec. 3-1s-20w.
S.D. at 1,909 ft.
A. H. Emenheiser's No. 1 Morrell, SE SW SE Sec. 17-3n-21w.
S.D. 910 ft.
Golden & Cochran's No. 1 Duncan, NE cor. Sec. 34-2n-21w.
Drlg. 1,505 ft. in lime.
Gypsy Oil Co.'s No. 1 Stokes, SE NW SW Sec. 11-1-20w.
Lime 1,709-11 ft.; T.D. 1,722 ft.; S.D.
Jack Kilgore's No. 1 Wooldridge, SW SW NE Sec. 15-3n-21w.
Drlg. 945 ft.
Loper et al's No. 1 Conrad, NE cor. Sec. 35-1s-19w.
Drlg. 720 ft.
Palo Duro Oil Co.'s No. 1 Ealum, SW SW SE Sec. 16-2-21w.
T.D. 840 ft.; S.D. for power unit.
Selby Oil Co.'s No. 1 Hold, SE SW Sec. 15-2-20w.
Granite wash 1,740-65 ft.; dry; S.D. 1,805 ft.; T.D.
Dick Scheig et al's No. 1 Cole, NE SE SE Sec. 5-1n-20w.
Granite wash 1,295-1,311 ft.; gas; 1,336-70 ft. dry; drlg. 1,489 ft.
Triangle Oil Co.'s No. 1 Fox, C E½ W½ NW Sec. 11-3n-20w.
Drlg. 125 ft.
Whatley & Whatley's No. 1 Holt, NW SW SE Sec. 20-1n-20w.
Drlg. 1,040 ft.

JEFFERSON COUNTY

Gypsy Oil Co.'s No. 1 James, SW SE SE Sec. 30-6s-6w.
R.U. standard tools.

JOHNSTON COUNTY

W. A. Delaney et al's No. 1 Diamond, NW NE SE Sec. 5-1s-8.
Drlg. 2,100 ft.

LOVE COUNTY

Amerada and Stanolind's No. 1 W. & D., NW SE SE Sec. 27-6s-2e.
T.D. 1,872 ft.; crooked hole; may skid rig for new hole.

MARSHALL COUNTY

Paul Robb's No. 1 Vittetoe, C NE SE Sec. 11-5s-4e.
Lime at 5,150-55 ft.; S.D. at 5,214 ft. for repairs.

McCURTAIN COUNTY

J. V. Scrivener et al's No. 1, NE SW SW Sec. 24-6s-21.
Machine.

MURRAY COUNTY

Equitable O. & G. Co.'s No. 1 Baer, SW NW NW Sec. 21-1s-3e.
Drlg. 320 ft.
Equitable O. & G. Co.'s No. 1 Scott, CSI N½ NW SW Sec. 15-1s-3.
S.D. 1,500 ft.; H.F.W.
Manahan et al's No. 1 Ward, NE SE NW Sec. 18-1s-3; (Wilcox sand test).
Top Bromide 1,166 ft.; sand 1,311-76 ft.; show oil in top and wtr. in base; T.D. 1,468 ft.; U.R. 8-in. csg.
C. P. Williams et al's No. 1 Singleterry, SE SW NW Sec. 25-2s-3e.
T.D. 743 ft.; S.D.

STEPHENS COUNTY

Wm. Angle et al's No. 1 Cooper, NE NW NW Sec. 23-2-7w.
Rigging up.
J. W. Madison's No. 1 Tussey, SW SE NW Sec. 24-1n-4w.
Rig down, drill pipe in hole; T D 3,230 ft.

La.-Ark. Wildcats

(Continued from Page 151)

ft. S and W NE cor. NE NW Sec. 20-9-13.
Dry and abd. 2,000 ft.
Laurel Pet. Co.'s No. 1 Long Bell Lbr. Co., 330 ft. N and E, SW cor. Sec. 14-8-14.
Rigging up.
Lawson-Leavell's No. 1 Whitney Corp., 330 ft. N and E, SW cor. NE SW Sec. 5-9-13.
Testing 3,196 ft.
Jack Lent's No. 1 Williams, Sec. 13-7-11.
S.D. 950 ft.
Dave McConnell's No. 1 Whiting Corp., Sec. 3-9-13.
W.O.S.R. 1,956 ft.
Strickland et al's No. 1 Whitney Corp., Sec. 32-10-12.
Recmt. 8-in.; T.D. 1,590 ft.

UNION PARISH

Southern Carbon Co.'s No. 66 fee, 660 ft. S, 1,980 ft. E, NW cor. Sec. 5-20-4e.
Set 12½-in. 176 ft.

WEBSTER PARISH

Virgil Likens' No. 1 E. L. Stewart, 1,020 ft. E, 600 ft. S of NW cor. Sec. 23-18-10.
Set 10-in. 41 ft.; W.O.C.

ARKANSAS
ARKANSAS COUNTY

Grand Prairie Realty Co.'s No. 1 Fischer, 200 ft. S and E, NW cor. NE NW Sec. 6-6s-4w.
Drlg. 3,440 ft.

ASHLEY COUNTY

Glenn E. McFaddin et al's No. 1 Boreine Farms, 660 ft. S and W, NE cor. Sec. 1-18-8.
Set 12½-in. 200 ft.; drlg. 1,850 ft.

COLUMBIA COUNTY

Southern States Gas Co.'s No. 1 Piney Woods Lbr. Co., 330 ft. N and E, SW cor. NE NW Sec. 10-20-22.
Set 10-in. 102 ft.

HEMPSTEAD COUNTY

A. H. Bagnelle's No. 1 Trattner & Rhinehart, Sec. 2-13-26.
S.D. 1,992 ft.

LAFAYETTE COUNTY

W. H. Harvey's No. 2 Allen, Sec. 18-19-24.
S.D. for fuel 1,500 ft.
Kamon & Neely's No. 1 Cockran, NW cor. SE SW Sec. 26-19-25.
Drlg. 2,805 ft.
Riggs Bros.' No. 1 Dubose, SE cor. SW NW Sec. 35-15-24.
Drlg. 2,380 ft.

LONOKE COUNTY

J. G. Strahan's No. 1 Hardin, Sec. 18-2s-7w.
S.D. 1,780 ft.

MILLER COUNTY

Ed Donohue's No. 2 Beck, Sec. 33-15-26.
Arranging to set csg. 2,933 ft.
Duluth-Ark. Oil Co.'s No. 4 Beck, SE cor. SE SW Sec. 34-15-26.
W.O.S.R. 2,941 ft.
M. D. K. Fitzwater's No. 1 E. H. Beck, 150 ft. N and E, SW cor. NW SW Sec. 34-15-26.
Set 10-in. 150 ft.
Fitzwater et al's No. 1 Norson, SW cor. SE SW Sec. 20-15-27.
S.D. 3,177 ft.
King Oil Corp.'s No. 1 C. H. Schroder, 200 ft. N, 330 ft. E. SW cor. SW NE Sec. 24-14-28.
S.D. 3,167 ft.
King Oil Corp.'s No. 1 Anderson, 350 ft. E, 200 ft. S, NW cor. SW NE Sec. 16-14-27.
S.D. 1,723 ft.
C. V. Lenz' No. 6 Dale, 273 ft. N, 430 ft. E, SW cor. SE NW Sec. 24-15-26.
Drlg. 2,490 ft.
A. C. Roan's No. 1 Frost Est., 150 ft. N and W, SE cor. SE SW Sec. 8-15-26.
Set 10-in. 120 ft.
Lee Timberlake's No. 1 Frost Est., 330 ft. N and E. SW cor. SW SE Sec. 27-15-26.
Coring 2,800 ft.

OUACHITA COUNTY

F. A. Book et al's No. 1 Arnold, Sec. 24-15-16.
S.D. 2,032 ft.
S. J. Carnes' No. 1 L. Caldwell, 330 ft. S and E, NW cor. Sec. 12-14-19.
Coring 1,908 ft.
S. J. Carnes' No. 1 Highsmith, NW cor. NE NW C of 2-ac. tract, Sec. 25-13-18.
Rigging up.
T. J. Gaughan's No. 1 J. Humphrey, 330 ft. N and E, SW cor. NE NE Sec. 30-13-17.
S.W. and abd. 1,455 ft.
Kraft Oil Corp.'s No. 1 Rath & Cartier, 330 ft. S and E, NW cor. SW SW Sec. 32-13-17.
Drlg. 1,720 ft.
J. D. Reynolds' No. 1 M. Bragg, 330 ft. N and E, SW cor. NW SE Sec. 25-13-18.
S.W. and abd. 1,405 ft.

UNION COUNTY

Alice-Sidney Oil Co.'s No. 1-B E. F. Gregory, 330 ft. N and W, SE cor. NW SW Sec. 10-17-14.
Comp.; through 2-in. tubing 822 bbls., at 3,377 ft.
J. E. Crosbie, Inc.'s No. 1 W. E. Gregory, 330 ft. S and E, NW cor. NE Sec. 15-17-14.
T.A. 3,503 ft.
J. E. Crosbie, Inc.'s No. 2-A E. F. Gregory, 330 ft. N and E, SW cor. NE SW Sec. 10-17-14.
W.O.S.R. 3,361 ft.
Comp.; pumping 265 bbls. at 3,361 ft.
Gardy Drlg. Co.'s No. 1 Craig, Sec. 35-17-15.
Tested oil and gas 2,211 ft.
Gulf Ref. Co.'s No. 49 L. Werner, 4,620 ft. N, 60 ft. E, SW cor. Sec. 5-16-16.
Drlg. 2,991 ft.
Reuter Oil Co.'s No. 2 Vines, NW cor. SW SE Sec. 29-18-14.
D.D. to 2,216 ft.; W.O.S.R.
H. L. Hunt's No. 15 E. F. Gregory, 330 ft. N and W, SE cor. Sec. 10-17-14.
Coring 5,765 ft.
H. L. Hunt's No. 18 E. F. Gregory, 330 ft. N and E, SW cor. Sec. 11-17-14.
Derrick.
Mrs. R. K. Jones et al's No. 1 Davis, 330 ft. N and W, SE cor. NW NW Sec. 28-16-14.
Set 7-in. 2,746 ft.; T.D. 2,765 ft.
Lion Oil Ref. Co.'s No. 6 H. L. Rowland, 330 ft. S and W, NE cor. Sec. 15-17-14.
T.A. 3,427 ft.
Marine Oil Co.'s No. 7-A W. B. Thompson, 330 ft. N and W, SE cor. SW SE Sec. 3-18-13.
Rigged up and S.D.
Joe Modisette's No. 1 Hill, Sec. 6-18-13.
Comp.; 3,500,000 ft. of gas at 2,563 ft.
Joe Modisette et al's No. 1 D. S. Sturdevant, 330 ft. N and W, SE cor. Sec. 6-18-13.
Testing 2,536 ft.
C. E. Murdock's No. 1 R. Pumphrey, C SW NW NE Sec. 11-17-14.
Derrick.
Reuter Oil Co., Inc.'s No. 1 J. L. Kinard, 330 ft. S and E, NW cor. SE NW Sec 32-18-14.
Pumping 2,189 ft.: no gauge.
Earl Patterson's No. 1 C. L. Smith, 1,130 ft. S, 550 ft. E, NW cor. Sec. 29-17-14.
Moving in rig.
Grady Vaughn's No. 1 T. B. Rowland, 330 ft. S and E, NW cor. Sec. 14-17-14.
Derrick.

MISSISSIPPI
AMITE COUNTY

Mineral Resources, Inc.'s No. 1 Anderson, C NE NW Sec. 14-3n-3e.
S.D. 550 ft.

BOLIVAR COUNTY

White & Jones' No. 1 Ballou, SE SE NW Sec. 17-24n-7w.
S.D. 20 ft.

CLARKE COUNTY

Clarke County Oil Co.'s No. 1 Dora Butler, C SW SW Sec. 15-2n-16e.
Set 10-in. 63 ft.

HARRISON COUNTY

Big Ridge Oil Co.'s No. 1 Hinzin, NE Sec. 13-7s-10w.
S.D.; W.O. 1,100 ft.

HINDS COUNTC

Bob Weaver's No. 1 T. Russell & Oparka, C NW SW NE Sec. 26-6n-1e.
Rigging up.

ISSEQUENA COUNTY

Pelican Oil & Gasoline Co.'s No. 1 Martin & Bender, 300 ft. S and E, NW cor. Sec. 11-12n-8w.
S.D.; curing titles, 3,227 ft.

JONES COUNTY

Snow-Black Pet. Co.'s No. 1 Fox, 400 ft. N, 750 ft. W, SE cor. SE SW Sec. 30-7n-13w.
Drlg. 1,150 ft.

LAUDERDALE COUNTY

Bob Dalton's No. 1 Bounds, Sec. 34-7n-15e
Arranging resume drlg. 560 ft.

MONROE COUNTY

P. J. McAlpine's No. 1 Frank Rye, Sec. 15-15s-17w.
S.D. 2,910 ft.
P. J. McAlpine's No. 1 Crook, 1,090 ft. S 90 ft. W, NE cor. Sec. 15-13s-13w.
Set 7-in. 1,880 ft.; drlg. 1,935 ft.

WALTHALL COUNTY

Mutual O. & G. Co.'s No. 1 Boyd, SW cor. SW SE Sec. 24-2n-9e.
Partly rigged up and S.D.

WARREN COUNTY

H. W. Elliott et al's No. 2 R. L. Parker, 780 ft. E, 1,570 ft. S, NW cor. Sec. 14-14n-1e.
S.D. for fuel 820 ft.

WASHINGTON COUNTY

Perkins & Dees' No. 1 Lee, 1,500 ft. E, 500 ft. N, SW cor. Sec. 33-15n-3w.
Set 10-in. 300 ft. and S.D.

WINSTON COUNTY

Jack Vale et al's No. 1 Moody, 713 ft. N, 667 ft. E, SW cor. NW SW Sec. 3-13n-14e.
S.D. 960 ft.

La.-Ark. Proven Fields

NORTH LOUISIANA
CADDO—BLANCHARD

M. Segall's No. 5 Sharpe, Sec. 11-18-16.
Rigged up and S.D.

CADDO—RODESSA

United Gas. Pub. Ser. Co.'s No. 1 Fosque Unit, 1,320 ft. N and E, SW cor. Sec. 35-23-16.
Drlg. 5,295 ft.
United Gas Pub. Ser. Co.'s No. 1 Johnson Unit, 1,245 ft. S, 1,365 ft. W, NE cor. Sec. 26-23-16.
Set 10¾-in. 2,100 ft.

SABINE PARISH—ZWOLLE

Alexander & Crane's No. 1 Fogman, SE cor N½ SW NE Sec. 18-7-11.
Set 6-in. 2,373 ft.
Ivan A. Allen's No. 1 La. Long Leaf, 330 ft. N and W, SE cor. NW SE Sec. 12-7-11.
S.D. 2,120 ft.
H. C. Mauilding's No. 1 Davis, 350 ft. N and W, SE cor. NE NE Sec. 2-7-11.
Rigging up.
H. C. Mauilding's No. 2 DeLatin, 330 ft. S and E, NW cor. NE SE Sec. 3-7-11.
Dry and abd. 2,587 ft.
K. C. Peterson et al's No. 1 Bowman-Hicks, 330 ft. S and E, NW cor. SW NW Sec. 2-7-9.
Derrick down.
Tex.-La.-Ark. Oil Co.'s No. 1 Pickering Lbr. Co., Sec. 3-3-12.
S.D. 2,742 ft.

EAST TEXAS (BORDER COUNTIES)
HARRISON COUNTY

R. C. Payne et al's No. 1 Lowery, E. D. Spain Sur.
P.B. to 3,524 ft.

MARION COUNTY

Ed S. Holman's No. 1 Henderson, R. Bennington Sur.
Drlg. 2,895 ft.

PANOLA COUNTY

R. W. Price's No. 1 Crawford, J. A. Williams Sur.
Set 10-in. 64 ft.
Fred Stovall Drlg. Co.'s No. 1 H. D. Ivey, P. Martin H.R.S.
S.D. for csg. 1,980 ft.
Thomason Drlg. Co.'s No. 1 Cadenhead, Jas. Smith Sur.
Drlg. 2,760 ft.

SHELBY COUNTY

Cliff Stovall's No. 1 Pickering Lbr. Co., C H. Pattersbn Sur.
S.D.; rig repair, 1,485 ft.
O. P. Bush, trustee's No. 1 Pickering Lbr. Co., P. W. Harvey Sur.
S.D. 730 ft.

ALABAMA
COVINGTON COUNTY

Geometer Prod. Corp.'s No. 1 Culbreath, SW cor. SW NE Sec. 8-2n-14e.
Reaming to bottom 3,300 ft.

HOUSTON COUNTY

Rice O. & G. Co.'s No. 1 Oakley est., SE cor. NW SW Sec. 9-3n-29e.
S.D.; W.O. 2,506 ft.

LAMAR COUNTY

DeSoto O. & G. Corp.'s No. 1 Gardner, Sec. 23-15s-16w.
S.D. 4,182 ft

WALTON COUNTY—FLORIDA

Geometer Oil Corp.'s No. 2 Walton Land & Timber Co., Sec. 16-1s-18w.
Rigging up.

NEW AND IMPROVED EQUIPMENT

Crutcher-Rolfs-Cummings Offers New Model Cleaner

Crutcher-Rolfs-Cummings, Inc., Esperson Building, Houston, Tex., announce production of a new W-K-M traveling type machine for cleaning pipe from 2 to 24-inch, inclusive. The new unit is a small, lightweight, power-driven machine

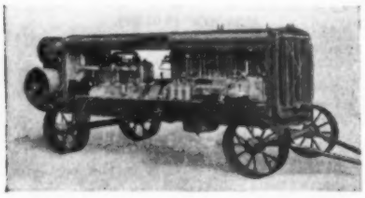
designed for small reconditioning jobs. It may be used to advantage also in cleaning new pipe prior to application of the priming coat.

This Model C machine, the manufacturers say, can be applied to or removed from the pipe in less than two minutes. A one-cylinder, air-cooled motor revolves cutter or brush head around the pipe at 110 revolutions per minute. Speed of cleaning is dependent upon the conditioning of pipe being handled and the degree of cleanliness desired, varying from 2 to 50 feet per minute.

The machine, according to the manufacturers, can be applied on the line by two men and operated by one man. It will traved in either direction and will clean up close to couplings, fittings, etc. Construction of the Model C machine is based on 15 years' experience in pipe cleaning problems.

Caterpillar Engine Drives New Schramm Compressor

A recent product announced by Schramm, Inc., West Chester, Pa., is a two-stage air compressor powered by a "Caterpillar" Diesel engine. With this



combination the operator gains the increased efficiency of two staging plus economy of Diesel engine operation. The compressor adopts the vertical water cooled design.

The manufacturer asserts that this two-stage design simplifies the flow of air. The compressors are available in five sizes and can be obtained with any type portable compressor mounting.

The first supply store for the Chandler district of Lincoln County, Oklahoma, has been opened by the Atlas Supply Co. The store is 1½ miles west of Chandler on Highway 66. A. J. Flowers is store manager.

Among the Equipment Houses

Frank Champion, general sales manager for the oil tool division of Byron Jackson Co., has started on a two months' trip planned to cover the Mid-Continent and New York.

—

W. C. Norris, Tulsa, has completed 53 years in the manufacture of oil well pumping supplies. The Norris shops ran without interruption during the depression and at the present time the machine shops are working three shifts.

—

C. W. Higbee, sales manager of United States Rubber Products, Inc., wire division, announces the appointment of C. P. Boone as manager of the company's wire sales on the Pacific Coast, with headquarters in San Francisco.

—

Earl Butler has been placed in charge of the Houston and Gulf Coast district for the Bridgeport Machine Co., Wichita, Kans. George Rossman, formerly East Texas representative for Bridgeport, has taken a position with the Pittsburgh Screw & Bolt Co. with headquarters in Kilgore.

The San Antonio Machine & Supply Co., with offices in San Antonio, Waco and Corpus Christi, Tex., has been made distributor for the Medart line of transmission equipment.

—

The Chapman Valve Manufacturing Co. of Indian Orchard, Mass., has opened offices at 1518 Petroleum Building, Houston, Tex., under the management of Robert F. Maher.

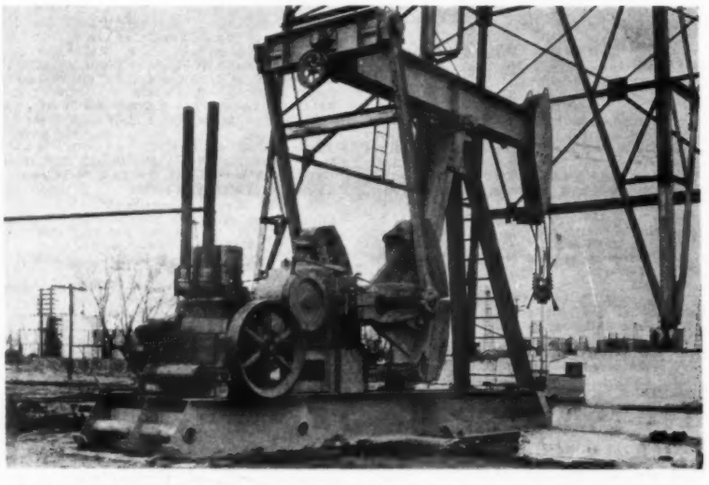
—

The Laclede Christy Clay Products Co., with main office and plants in St. Louis, Mo., announces the removal of its Chicago district sales office to its new headquarters and warehouse at 4452 West Fifth Avenue, Chicago. H. R. Hiller is district manager.

—

Formation of the National Copper Paint Co., an Illinois corporation, to manufacture and market a newly developed liquid paint which is said to have many uses in the oil industry, is announced by C. L. Welch, executive vice president. Headquarters are at 666 Lake Shore Drive, Chicago.

Ideco Announces New Series of Geared Pumping Unit



Continental Oil Co.'s No. 2 Vineta Park well which recently started pumping in the Oklahoma City field with an Ideco twin crank double reduction geared unit. The first well pumped in that field used an Ideco standard steel rig front, which is still in operation

A new series of geared pumping units announced by the International Derrick & Equipment Co., is designed to reduce oil production costs through greater overall pumping efficiency and simplified installation, operation and maintenance.

These new Ideco twin crank, double reduction geared pumping units have all parts mounted on a rugged, all-welded, steel skid base, saving installation time and assuring proper alignment of parts. Careful engineering is said to have distributed loads and eliminated vibration so that there is little need for anchoring the unit in place or building any special base. Unit assembly is an advantage when pumping is abandoned at one well and the equipment transferred to a new location. Interchangeability of parts is another feature.

Mechanical features include double reduction gearing, for use with either slow or high speed prime movers; all gears cut on new Sykes machines; gear wheels made of heat-treated cast steel and pinions forged integrally with the pinion shafts from heat-treated alloy steel billets; gears of the generated continuous tooth herringbone type, lapped in after cutting and before assembling into the units; gears run in an oil bath and a positive system of lubrication circulating oil continuously through every moving part. All shafts are of generous proportions to minimize deflection under load.

Pumping units in this new DT series are available in sizes ranging from 10 to 75 horsepower and for use with any type of prime mover. The company has offices in Beaumont, Tex., Columbus, Ohio; and Los Angeles, Calif.

Men Well Known in the Equipment Field

American Meter Co. has appointed E. S. Dickey executive representative. He will remain at the Maryland Meter Works office, 309 East Saratoga Street, Baltimore, Md. This new post marks another step to perfect service and sales

E. S. DICKEY

organization simultaneously with modernization and consolidation of plant and manufacturing facilities. Suspension of production activities in the Baltimore factory will enable Mr. Dickey to devote more time to gas company customers.

Mr. Dickey entered the meter business in 1889 as an apprentice with Dickey, Tansley & Co., predecessor of Maryland Meter Works. In 1899 he became works manager and in 1911 general manager of Maryland Meter Works. He had a leading part in the development of the B type meter and collaborated with the late George A. Lane in the development of the double-diaphragm, large-capacity C type meters. From 1930 to 1931 he was chairman of the manufacturers section of the American Gas Association.

New Desander Introduced for Rotary Drilling Mud

A new desander for rotary drilling mud developed by the Merco Centrifugal Separator Co., Ltd., 343 Sansome Street, San Francisco, embodies the same basic principles used in the large Type A-30 separator. The new model, for smaller capacities, will desand from 100 to 200 gallons of mud per minute, depending upon its viscosity, which is ample for a central mud plant handling four to six wells.

The new separator is a self-contained unit mounted on a single base and operated by an electric motor. It is designed to extract substantially all sand from the mud. It embodies only one moving part, the rotor suspended from an oscillating radial-thrust bearing at the top.

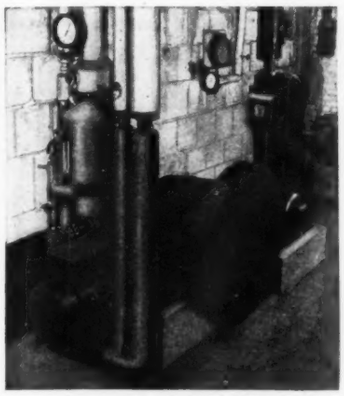
The principle of operation is simple. The feed, after passing through a coarse screen to remove large debris, enters the rotor at the top and immediately comes under the influence of the centrifugal force. The settling force is 67 times that of gravity. The heavy components of the feed are projected to the periphery of the rotor while the "clean" carrying fluid passes out of the rotor over a weir near the center.

The solids, concentrated in some fluid,

pass out of the rotor at the periphery through a series of nozzles. A large part of this discharge drops to the bottom of the housing, where it is picked up by the rotor and returned to the periphery. This return furnishes means for further concentrating the solids and flushing the entrance to the nozzles. The remainder of the discharge from the nozzles passes through a specific gravity device which regulates the density or concentration of the discharge. This separator may be employed to prevent the loss of mud-weighting material.

Steam Booster Compressor Developed by Worthington

Of interest to steam power plant operators and steam users generally, is the steam booster compressor offered by Worthington Pump & Machinery Corp., Harrison, N. J. Its purpose is to take steam from an existing boiler system, raise its pressure beyond the capability



of the boiler itself and distribute it to points of demand. This booster has been developed to take care of situations where, as often happens, a supply of steam of higher pressure than can be obtained from the available steam sources is required for some phase of manufacturing process, or to increase pressure in steam that has been carried through long pipe lines, etc.

Under these conditions, where the demand for higher pressure steam is within a reasonable capacity, the installation of a Worthington steam-driven or motor-driven steam booster compressor solves the problem, and the machine will supply steam at the necessary pressure at a fraction of the cost of a new boiler with accessories. Little attention to the machine is required, and the steam pressure or temperature determined upon can be regulated within close limits. This is especially applicable to the many chemical or special industrial processes where a definite temperature must be continuously maintained with practically no variation.

CABINET TYPE METER PANEL

A cabinet type steel meter panel equipped with doors to protect and conceal meter and control connections is now offered by Bailey Meter Co., Cleveland, Ohio. The neatly paneled doors are provided with a 3-point locking mechanism and a substantial cylinder lock which may be used to prevent access to electrical connections, control mechanisms and meter adjustments within the cabinet. These panels are made of one-piece sheet steel plate formed in sizes to give symmetrical and uniform appearance.

NEW MASK OUTFIT DEVELOPED

To meet the flexible requirements of many users of gas masks, a new type of outfit, stressing portability, has been developed by E. D. Bullard Co., San Francisco. Known as a reel hose mask, the apparatus consists of a standard face piece and body harness, air hose mounted on a portable reel, and a portable aluminum blower, which may be removed from the carrying trunk. The light weight of these units makes it possible to carry them from place to place without trouble.

Notes About Trade Literature

The 1935 "Operators Handbook," containing information on truck and industrial tires, has just been published by the B. F. Goodrich Co., Akron, Ohio. The booklet, containing 44 pages, is available upon request.

The Hays Corp., Michigan City, Ind., is mailing on request Bulletin 2017, which illustrates and describes a new line of series OT and series OH draft, pressure and differential recorders for ranges between .1 and 100 inches water total scale.

A bulletin covering Beco-Turner baffles for water-tube boilers is obtainable from the Plibrico Jointless Firebrick Co., Chicago.

Following last year's announcement that its silent chain had been given a distinctive "dress" and named Silverstreak because of the silvery streak it describes in operation, Link-Belt Co., Indianapolis, Ind., has released a pictorial 32-page book, No. 1425, which describes this high speed chain drive.

A 32-page catalog on the MacClatchie "Hydro-Seal" plug valve and a general catalog listing all MacClatchie products may be obtained from MacClatchie Manufacturing Co., Compton, Calif.

Tag pyrometers, indicating controllers and recorder-controllers are described in an illustrated mailing piece in colors, obtainable from the C. J. Tagliabue Manufacturing Co., Park and Nostrand Avenues, Brooklyn, N. Y.

The Calyx core drill (making holes up to 72 inches in diameter and 50 feet deep, or smaller holes, with their cores, up to 11½ inches in diameter and 2,500 feet deep) is described completely in a 48-page bulletin offered by the Ingersoll-Rand Co., 11 Broadway, New York.

"How to Choose Valves" is among articles in the current number of Valve Values, published by the Edward Valve & Manufacturing Co., Inc., East Chicago, Ind.

A new technical bulletin on the use of nickel and monel metal to defeat corrosion by chlorinated solvents, of interest to oil refiners, is sent on request by the International Nickel Co., Inc., 67 Wall Street, New York. The work was prepared by the company's research staff.

The Parker Appliance Co., 10320 Berea Road, Cleveland, Ohio, has for distribution a 60-page booklet covering a typical variety of valves manufactured by that company.

Machine for Blueprinting Uses the Angstrom Lamp

A blueprint machine which utilizes the new Angstrom blueprint lamp has been placed on the market by Milligan & Wright Co., 4717 Prospect Avenue, Cleve-

land, Ohio. The lamp is of the incandescent type and operates from the regular 110-115 D.C. or A.C. lighting circuit without the need of transformer choke coils, etc. It differs from the ordinary incandescent lamp in that the quality of light produced is stronger in the blue end of the spectrum.

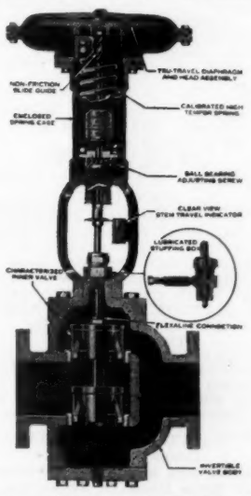
The Model 100 pictured here is the portable table type which will print one 18x24 or two 12x18, or four 9x12 prints at one time. To make a print it is only necessary to place tracing and paper on the plate glass top, lower the pressure pad and close the cover. The springs in the cover act on the pressure pad, assuring good contact between tracing and paper. The automatic time switch is turned on and set for about one minute exposure. (The length of exposure depends on the speed of paper used.) When the time switch clicks off remove the print and wash it in water and potash solution in trays provided for this purpose. The print is then dried on a special drying board furnished with the machine. One print can be made as economically as a dozen.

In addition to attractive reading matter the current number of the Lufkin Line, published by the Lufkin Foundry & Machine Co., Lufkin, Tex., pictures interesting installations of the company's pumping units.

Offers Diaphragm Control Valve for Pilot Operation

In the new diaphragm control valve for pilot operation designated as the Fisher type 57-T Tru-Travel control valve, the Fisher Governor Co., Marshalltown, Iowa, says it has engineered every point of construction to accomplish a definite purpose.

The inner valve, being the heart of the control, has received special attention, because on this part depends the reaction of the flow through the valve. To perform a certain function of flow the inner valve must have definite design characteristics. The valve must have a finer throttling ability over the first increment of lift, then proceed to throttle or float in proper ratio to the travel until the maximum capacity is reached. These valves having such engineered character-



istics have been named "Fisher characterized inner valves."

Not all controls require "characterized inner valves," and in such cases the more common type bevel-seated or plain V-notch are used, but in every case the inner valve in every Fisher regulator is engineered for the specifications given on the order. Flexaline, the patented valve stem connection designed to assure a nonbinding inner valve, is used on all standard Fisher control valves.

Miller Cutoff Increases Safety Against Accident

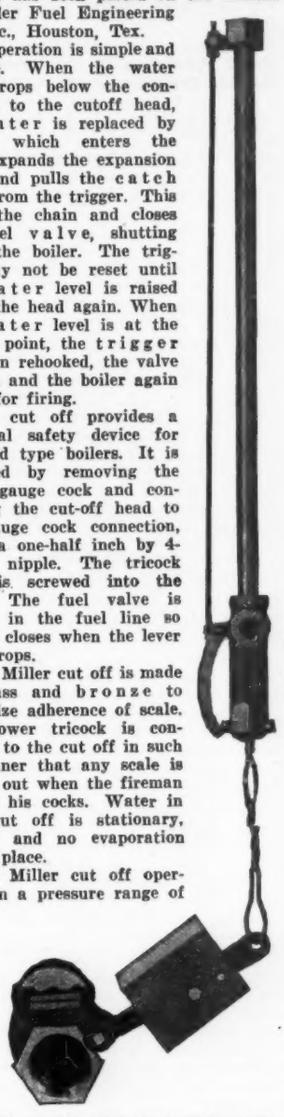
A new low water cutoff for protecting against crownsheet failures and boiler explosions has been placed on the market by Miller Fuel Engineering Co., Inc., Houston, Tex.

Its operation is simple and positive. When the water level drops below the connection to the cutoff head, the water is replaced by steam, which enters the head, expands the expansion tube, and pulls the catch away from the trigger. This drops the chain and closes the fuel valve, shutting down the boiler. The trigger may not be reset until the water level is raised above the head again. When the water level is at the proper point, the trigger chain in rehooked, the valve is open and the boiler again ready for firing.

This cut off provides a practical safety device for oil field type boilers. It is installed by removing the lower gauge cock and connecting the cut-off head to the gauge cock connection, using a one-half inch by 4-inch nipple. The tricock then is screwed into the head. The fuel valve is placed in the fuel line so that it closes when the lever arm drops.

The Miller cut off is made of brass and bronze to minimize adherence of scale. The lower tricock is connected to the cut off in such a manner that any scale is blown out when the fireman checks his cocks. Water in this cut off is stationary, cool, and no evaporation takes place.

The Miller cut off operates on a pressure range of



0 to 500 pounds. The two working parts are on the outside, easily inspected.

DEARBORN CHEMICAL PUMP

A new chemical pump is announced by the Dearborn Chemical Co., 310 South Michigan Avenue, Chicago. It was developed especially for pumping exact quantities of water-treating chemicals into water supplies at intervals, dependent upon the rate of water flow. However, the pump is adaptable to any type of liquid or semiliquid chemicals and for close proportioning of coagulants. The pump presents a combination of improved features in operation, adjustment and design. Stroke adjustment can be set accurately from 0 to 3 inches. The plunger is adjustable for complete cylinder displacement, eliminating air pocketing. This new Dearborn pump may be operated by any type of actuating device: water power, electric motor, ratchet or reciprocating motion, chain or belt drive. Height overall is 23½ inches; approximate weight 125 pounds. This pump in connection with the Dearborn agitator type chemical vat makes a complete water-treating unit.

The model K Berg cleaning tool for cleaning steel and other hard surfaces, such as tanks, drums, trucks, etc., is the subject of a bulletin mailed for the asking by the Berg Cleaning Tool Division, Concrete Surfacing Machinery Co., 4667 Spring Grove Avenue, Cincinnati, Ohio.

Central West Fields

(Continued from Page 147)

David Stoneburner farm, Lot 1, Willis Township. H. P. Muhlback & Son are drilling Nos. 7, 8 and 9 on the Thomas Stewart farm, Section 21, same township.

In Perry County, Mid-East Gas Co.'s No. 3 Edward Noll farm, Section 24, Reading Township, is dry at 861 feet.

In Stark County, Perry Township, East Ohio Gas Co.'s No. 1 John Graber farm, Section 23, is reported dry at 4,545 feet. Ohio Fuel Gas Co. is starting No. 3-5973 on the A. J. Stoner farm, Section 3, Jackson Township. Wittmer Co. is drilling below 1,200 feet in No. 1 Anna Wagner farm, Section 5, Lawrence Township. East Ohio Gas Co. is shut down at 300 feet on No. 4 Howard Fawcett farm, Section 17, Jackson Township.

In Licking County, Long Producing Co. has a rig for No. 2 on the William Varner farm, Section 14, Fallsburg Township. G. H. Long lost the tools in No. 3 Eliza Fulton farm at 300 feet, and abandoned the hole. H. P. Muhlbach has a location on the Wm. O. Burrier farm, Section 5, Licking Township. Utica Gas Co. has a rig for No. 3 Glenn Shipley farm, Sections 14-15, Bennington Township. Settles Oil Co. has a rig on the Oran Evans farm, Section 2, Mary Ann Township, same county.

Trumbull County

In Trumbull County, Kime and others are drilling on the Lawrence Booth farm, Section 24, Vienna Township, at 300 feet.

In Fairfield County, City Natural Gas Works is moving a rig for No. 1 Daniel Steiger farm, Section 1, Greenfield Township. Same company is drilling No. 2 on the Webster Deeds farm, Section 34, same township, and is drilling No. 4 Charles Fauble farm, Section 2, same township.

In Meigs County, Joe Rubin and others are drilling No. 5 on the Elias Jividen farm, Section 36, Lebanon Township, at 465 feet. Meigs Developing Co. is drilling below 1,225 feet in No. 2 Addie Philson farm, Section 30, same township, and Ray Holmes and others are drilling below 1,300 feet in No. 1 on the Emil Johnson farm, Section 35, same township. Irvin Fleming is drilling on his farm, Section 8, Rutland Township. Star Mills Co. is having trouble with casing in No. 2 on the Rena E. Karr farm, Section 11, Sutton Township.

There were no reports from the Indiana, Illinois and Kentucky Fields for the week.

Many blocks of land for development work in Tennessee have been taken up, especially in the southwestern area of the state.

Tentative Program for Natural Gas Convention

(Continued from Page 164)

Tonkin. The remainder of the morning will be devoted to the sales, utilization, advertising and load building problems. There will be an address on "Air Conditioning," and a paper on "Whole Organization Attention to Sales." E. M. Tharp of the Ohio Fuel Gas Co., was assigned to this paper with S. B. Severson of the Republic Light, Heat & Power Co. of Buffalo to lead the discussion. F. M. Rosenkrans, chairman of the commercial section of the A.G.A., probably will give a report of his section.

Thursday morning, May 9—Address by John W. Finch, new director of the U. S. Bureau of Mines. Address, "Natural Gas Reserves and Conservation Thereof," H. L. Dickerson. Address, "Improvements in Gas Transmission," speaker to be selected.

Tentative plans call for some entertainment event for Thursday afternoon. The general entertainment has not yet been arranged.

John B. Tonkin presided at the program committee meeting with William Moeller, Jr., of Los Angeles, as vice chairman. Captain Higgins was secretary.

Those present were: W. J. O'Brien, Memphis; F. L. Chase, Dallas; J. D. Creveling, New York; H. L. Dickerson, New York; Edgar G. Hill, New York; William Moeller, Jr., Los Angeles; J. B. Tonkin, Pittsburgh; R. W. Hendee, Tulsa; B. F. Pickard, Tulsa; E. L. Rawlins, Bartlesville; Frank Smith, Houston; R. G. Soper, Dallas, R. E. Wertz, Amarillo; Paul Renshaw, Memphis; Douglas Buckler, Los Angeles; Lester Moore, Shreveport; C. D. Greason, Kansas City, Mo.; Will C. Grant, Dallas.

NATURAL GAS IN BUCHAREST

The municipality of Bucharest, Rumania, is negotiating with the principal oil companies for utilizing natural gas from oil wells for lighting purposes, and it is said a provisional contract has been drawn up. Rumanian Consolidated Oilfields, Ltd., of the Phoenix group obtained a concession from the town of Ploesti which gave it the monopoly for the supply of natural gas for the town before the war and after the war the concession was resuscitated. For many years the town has been supplied with this gas through an extensive network of pipe lines, the gas being stripped of its benzene content. The company has shown considerable enterprise in the introduction of modern apparatus for the use of gas supplies and the inhabitants have shown their appreciation of the economy and convenience of this new form of light and fuel as opposed to wood, which was previously used.

CLASSIFIED ADVERTISING

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MONTHLY PAYING ROYALTIES
Quoted Dealers Exclusively.
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Suite 812, Palace Bldg., Tulsa, Okla.

PRODUCING OIL ROYALTIES
for dealers.
H. P. BOWEN
842 Kennedy Bldg., Tulsa, Okla.

Producing Oil Royalties
at wholesale.
ROBERT L. KINKAID, INC.
Petroleum Bldg., Oklahoma City, Okla.

Income Producing Royalties
Mid-Continent Field
Harry A. George
427 Perrine Bldg., Oklahoma City, Okla.

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EAST TEXAS AND VAN POOL
PRODUCING OIL ROYALTIES.
We Buy and Sell.
E. T. MARION REAL ESTATE CO.
401-2 Slaughter Bldg.,
Dallas, Texas.

PRODUCING OIL ROYALTY paying monthly income in half acres and upwards at reasonable prices. Federal listed. S. J. Jewell, P. O. Box 35, Tulsa, Okla.

J. A. WOLF AND COMPANY
105 West Adams Street
Chicago, Illinois
Dealers in Oil Royalties since 1918.

VAN POOL — EAST TEXAS
Bought — Sold — Wholesale.
W. R. Brown & Co., Inc.
14 Prospect St., East Orange, N. J.

PERMIAN BASIN oil structures are under development in a big way. All dealers in under-the-drill royalties, please get our new offering. It will interest you. W. J. Dobbs, 632 Wilson Bldg., Dallas, Tex.

PRODUCING OIL ROYALTIES
Bought (Wholesale) Sold
Inquiries invited from Oil Companies, Bankers, Dealers.
M-K OIL COMPANY, INC.
20 Broad St. New York.

ROYALTY and Leases, Wheeler and Gray Counties, Texas. For quick direct deals get in touch with
E. B. REEVES,
Lock Box 475, McLean, Texas.

VAN POOL
PRODUCING OIL ROYALTY
We will sell 1 to 5 Royalty acres covering a tract which participates in the 600 ft. Oil sand contour. Base price $2700. If interested ask for SEC schedule "A" which gives full information.
E. T. MARION REAL ESTATE CO.
401-2 Slaughter Building,
Dallas, Texas.

WILL assemble ten thousand acre block in Eastern part Donley County, Texas, for well and reasonable price for assembling. References. Box 914, Hedley, Tex.

GULF COAST ROYALTIES
Bought and Sold.
Producing and non-producing royalties in salt dome fields of Texas and La.
ZENI OIL COMPANY
412 Esperson Bldg., Preston 4420,
Houston, Texas.

Texas Royalties or Oil and Gas Leases for brokers and dealers only.
H. H. WHITE
1705 Western Ave., Fort Worth, Texas.

OIL REPORT SERVICE
Specimen Copies and Particulars on Request.
OIL INFORMATION BUREAU
501-04 PETROLEUM BUILDING
OKLAHOMA CITY, OKLAHOMA.

Royalties—Production

ANDREW J. BARRETT
The Philtower
Tulsa, Oklahoma.

VAN POOL OIL ROYALTY
(EAST TEXAS OIL ROYALTY)
Bought — Sold
67 Wall St., Suite 810, New York.

Own and Offer for Sale
PENNA. OIL AND GAS LEASES
Producing Royalties and Working Interests in the best producing areas.
ROBERT E. LEYENDECKER
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BROKERS — SALESMEN
Sell in the most active area in the United States — The Permian Basin of West Texas and Southeastern New Mexico. From the standpoint of royalty investors this area has much to offer. Can supply you with choice non-producing royalties located on geophysical highs. Also drilling blocks, close in acreage to production, or wildcat leases. I maintain my own field men who cover this area for me. Complete set of Forms and Reports for filing with Securities and Exchange Commission accompanies every order. Inquiries invited.
B. D. BUCKLEY
Paul Brown Bldg., St. Louis, Mo.

PRODUCING ROYALTIES

for

DEALERS ONLY

Write for Details on $165,375.00 Registered royalty issue, which is now ready for sale to the public.

CHESTER IMES

First National Bldg.,
Oklahoma City, Okla.

— ROYALTY DEALERS —
AM FIELD MAN FOR OTHERS;
WHY NOT YOU?
CHARGE 5% COMMISSION
Am specializing as a field man in producing and non-producing royalties, production and blocks in Oklahoma and Texas. Am experienced and have been in Tulsa 17 years. Will give you quick service. References if desired.
W. D. McCOY
Phone 2-4311 217 W. 5th St.
Tulsa, Oklahoma.

I OWN and will sell the best producing royalties in Van, East Texas and Wheeler County, Texas, Fields. I own 500 acres full one-eighth land owners' royalty participating in rentals under major companies. Heavy development under way. $4.00 an acre, rentals paying 6¼% interest in advance. Will buy royalty in Texas and Oklahoma in any amounts. P. R. KNICKERBOCKER, 3237 Westminster St., Dallas, Texas.

HIGH GRADE producing oil and gas royalties offered to dealers. Billie Smallwood, P. O. Box 2261, Tulsa, Okla.

Oklahoma, Kansas and Texas producing and non-producing royalties. James R. HAYNES, Grantville, Kansas.

COASTAL LOUISIANA. Invest wisely in select royalties on known geophysical structures. 208 Weber Bldg., Lake Charles, La.

Royalties—Production

East Texas Woodbine Sand and West Tex. Permian Basin wells drilling. Cheap leases Royalties. E. Croft, Proctor, Tex.

Warehouse Facilities

TULSA WAREHOUSE AND STORAGE SPACE
3500 sq. ft. of storage space in fine Brick Bldg. on Frisco Tracks. Heavy concrete floor, additional outside yard space, suitable for oil well supplies or other storage purposes. Balance of Bldg. occupied by owner. Low rental.
C. F. MARTIN
Box 1326, Tulsa, Okla. Phone 3-2644

Financing

JAMES E. MILLER CO., 207½ E. Third St., Tulsa, Okla., will co-operate with responsible parties seeking aid in financing projects of higher order.

PROSPECTUSES prepared and deals shaped up for registration or exemption under Federal Security Act. Fee basis. John Morris, Seventh Floor, 1237 Market St., Philadelphia, Pa.

CAPITAL—An experienced dependable broker will aid in financing projects of merit. AMSTER LEONARD, 316 South Clark St., Chicago.

Situations Wanted

Technical grad. with 15 yrs.' experience with major oil companies in design, construct. and mainte. of ref. equip., desires to make a change. Address Box G-604, The Oil and Gas Journal, Tulsa, Okla.

MARKETING Salesman. Well educated, adaptable, experienced young man. Seven years' successful sales background throughout Northwest. Employed at present but desires change to Southwest. Best references. Can bring some business along. Address Box G-602, The Oil and Gas Journal, Tulsa, Okla.

LUBRICATION ENGINEER—Graduate Mechanical Engineer, past experience, developing, testing, petroleum products, taking care of Lubrication Complaints working with salesmen and agents selling large users of Petroleum products, experts on Lubrication on all types engines and machinery. Have sales as well as engineering ability. Member of Society Automotive Engineers. Willing go anywhere. Can furnish best of references from major oil company. Available at once. Address Box G-601, The Oil and Gas Journal, Tulsa, Okla.

HAVE established location central point East Texas. Can represent Manufacturer Sales and Stock for distribution of Oil Field Specialties either through Supply Stores or Direct. Address Box G-612, The Oil and Gas Journal, Tulsa, Oklahoma.

SALESMAN AND CHEMIST
Graduate Chemist, seven years' experience refining, construction and sales. Best References. Address Box G-611, The Oil and Gas Journal, Tulsa, Okla.

ACCOUNTANT — OFFICE MANAGER. Desires position. Locate anywhere, age 34, married, 15 years' experience Accounting, Sales and Traffic work. Last eight years oil business. Capable and energetic. Best of references. Address Box G-610, The Oil and Gas Journal, Tulsa, Okla.

Help Wanted

WE BELIEVE OUR METHOD to be the quickest and surest for locating new oil and gas pools. A representative wanted in each state. The Mid-West Development Company, 423 Cuyahoga Bldg., Cleveland, Ohio.

CLASSIFIED ADVERTISING

For Sale—Equipment

REFINERY EQUIPMENT — WAX PLANT — VALVES — TANKS

Two 35 ton refrigerating units, two 325 plate 48" Carbondale wax presses with all necessary wax plant equipment. All kinds of condenser coils, cast iron pipe, condenser boxes, all sizes steam and motor driven pumps, 50,000 valves and fittings, Oakite treated and tested, other equipment. 300 all sizes steel storage tanks from 100 bbl. to 55,000 bbl.

EVERYTHING IN THE REFINERY LINE AT BARGAIN PRICES.

SONKEN-GALAMBA CORPORATION

64 N. Second St., Kansas City, Kansas.

FOR SALE

8000 ft. 8¼" Casing 28 lb. standard couplings 8thread.
2000 ft. 8¼" Casing 32 lb. Long couplings 8thread.
5000 ft. 8¼" Casing 32 lb. Long couplings 10thread.

Located in the Ranger district, Texas. This pipe is of A-1 condition. Communicate with Acme Salvage Co., of Longview, Texas, or Okmulgee Supply Corp., of Okmulgee, Okla.

Four—300 HP 3 Cyl. Rathbone Jones Gas Engines.
One—65 HP 3 Cyl. Nash Gas Engine.
One—40 HP 2 Cyl. Nash Gas Engine.
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Steel Building—New, unerected. 445' x 730', 5 units, 89' each, equipped for 20-ton Cranes. Will separate.
Cars and Car Repair Parts, Locomotive Cranes, Rails, etc. Diesel and Steam Power Plants, Turbines, Motors, Generators, etc.

IRON & STEEL PRODUCTS, INC.
Railway Exchange, Chicago, Ill.
Beacon Life Bldg., Tulsa, Okla.
"Anything so long as it contains Iron or Steel"

COUPLINGS FOR SALE

5,000 4" 8-thread Recessed Line Couplings.
5,000 3" 8-thread Recessed Line Couplings.

Wire or write for prices to:
THE TRI-STATE PIPE COMPANY
Bellaire, Ohio.

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21 HIGH PRESSURE HAMMER-WELD TANKS

Same as new. Wall thickness ⅜ in.—head thickness ⅛ in.—Length 19 ft. 8 in. Diameter 4 ft. 2 in. Working pressure 150 pounds. Test pressure 300 pounds. Used until recently as gas receivers in a compression plant. Will sell individually or entire lot. Price slashed for immediate sale.

1—NATIONAL TRANSIT HOT OIL CHARGING PUMP

Steam driven; 10 x 16 x 5½ x 12; synchronized valve assembly; piston type; forged steel liquid end; 600-lbs. pressure; capacity 75 GPM; Temperature 700° F.; Fisher Governor; very good condition; slightly used. Bargain for quick sale.

BROWN-STRAUSS CORP.
Pipe—O.D. Tubes—Refinery Equipment
1402-1720 Guinotte Ave.,
Kansas City, Mo.

WHEN YOUR Electric Motors give trouble phone 4994 collect. Rawls Electric Works, Abilene, Texas.

FOR SALE—8 wheel Martin wagons, No. 12 Westinghouse fluid positive gas meters, Star Manufacturing Company steel tool boxes, 2⅜" OD and 2⅞" OD P & T reconditioned kick off collars, Williams flow devices, and 1-gallon Fyr-Fyter fire extinguishers. I. T. I. O. Company, Bartlesville, Okla.

COMPRESSORS FOR SALE

21 Ingersoll Rand Imperial Type X O B Compressors, with 76 and/or 100 H.P. Motors. Braun Coolers. Okmulgee Supply Corp., Okmulgee, Okla.

Keystone drilling machine, large size, steel frame, Ajax 12 x 11 engine, boiler, connections. C. H. Reser, Hamilton, Kans.

For Sale—Equipment

FOR SALE, 3½" x 10" Gaso portable pumping unit with Continental motor. General Machine & Supply Co., Wichita Falls, Texas.

FOR SALE — Complete Rotary Drilling Tools, 2750 ft. 4" drill pipe, twin engine, complete invoice on request. Material in good condition. CITIZENS OIL AND REFINING CORPORATION, Luling, Texas.

KEYSTONE Driller, size 5½ equipped with new McCormack-Deering Gas Engine, also tools, $1000.00. Address Keystone, Box 1123, Texarkana, Tex.

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25 K.W. and 40 K.W. Gas Engines, 220 volts, D.C. Two 100 K.W. Gas Engine Generator Sets, 220 volts, D.C. 7x6 Ingersoll-Rand ER-1 Air Compressor. Six-inch Oster Pipe Threading Machine. Also large stock of lathes, pipe machines, milling machines, etc. Send for our list.

Terms to suit.
CINCINNATI MACHINERY & SUPPLY CO.
26 West 2nd St. Cincinnati, Ohio.

OIL ENGINES

2—600 HP McIntosh Seymour Diesel Engines, 6 cyl., 16½"x24", 200 RPM, Type 6B-33, serial No. 1836 and No. 1837, Weight 168,000 lbs. ea.; purchased 1923, actual service 8000 hrs. ea. Out of service 1927. With or without direct connected Worthington Oil Pumps. At Tea Pot Dome Pumping Station, Casper, Wyo. SONKEN-GALAMBA CORPORATION 64 N. Second St., Kansas City, Kans.

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Classified Advertising rates are 35 cents a line for the first insertion and 25 cents a line for each additional insertion, PAYABLE IN ADVANCE.

Six words usually constitute a line.

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	1 time	2 times	3 times	4 times
3 lines	$1.05	$1.80	$2.55	$3.30
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6 lines	2.10	3.60	5.10	6.60
7 lines	2.45	4.20	5.95	7.70
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10 lines	3.50	6.00	8.50	11.00

To avoid delay be sure to send remittance with copy. Over payments will be refunded. One time insertions will not be run until fully paid.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma

Equipment Wanted

WANTED — Couplings, Thread Protectors—14" and larger. In good condition. Address Box G-561, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Gas repressuring equipment for 900 ft. wells with 6 to 16 ft. of producing sand. Munfordville Oil & Gas Co., Munfordville, Ky.

DRILLING machine, late model, good condition, prefer tractor type with Diesel or Semi-Diesel or Gasoline engine, but will consider other types. For drilling 12" hole to 2000 feet, in State of Colorado. Give full particulars. State lowest cash price or terms. B. Moisant, 6131 Rhodes Avenue, Chicago, Ill.

Oil Industry Printing

OIL FIELD LEGAL BLANKS

Leases, assignments, releases, township plat books, well records, etc. Request on your letterhead gets free catalog. Olds Press, 215 East Third St., Tulsa, Okla.

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Before disclosing your invention to anyone, send for blank form:
"Evidence of Conception,"
Instructions "How to Establish Your Rights" and complete information FREE!
LANCASTER, ALLWINE & ROMMEL
418 Bowen Building,
Washington, D. C.

Incorporations

CHARTERS—Delaware best, quickest, cheapest, most liberal. Free forms. Colonial Charter Co., Wilmington, Del.

DELAWARE CHARTERS — Fee small; submitted forms. Chas. G. Guyer, 901 Market Street, Wilmington, Del.

For Sale—Maps

OIL MAPS

The best ownership and general-area maps, large or small scale found in the oil industry; cover any active County or Parish or "hot spot" in Texas or Louisiana.

W. W. Zingery, Houston, Tex.
The World's Best Oil Map Maker.

Leases—Production

EXCEPTIONAL DRILLING OPPORTUNITY: Community financed well, partly drilled, present operations prove extra good geology report, engine, derrick, equipment on location, will make most attractive offer to competent driller who will complete well. Wenatchee Valley Oil & Gas Co., Wenatchee, Wash.

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1 inch	26 times	4.00
1 inch	52 times	3.50

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One-point borders and 10-point capitals are allowed; larger type not accepted.

To avoid delay be sure to send remittance with copy. Over payments will be refunded. One time insertions will not be run until fully paid.

THE OIL AND GAS JOURNAL
Tulsa, Oklahoma.

Leases—Production

WILL LEASE for 3 years, at reasonable prices. 80 acres, 29-14-7, Creek Co.; 20 acres, 29-16-14, Okmulgee Co.; 40 acres, 18-3-19, Latimer Co. and 160 acres, 9-5-21, McCurtain Co., Okla. Write C. Cohn, Whiteville, Tenn.

---

10 ACRES, Balcones Fault area, part of lease upon which Edwards test is in active operation, $25.00 per acre. You must act at once as chalk is high and thin chalk will boom prices. We confidently believe that this lease will command $500 per acre within 30 days. NICOLLE, Geologists, Box 903, Houston, Texas.

FOR SALE— 40 acres oil land Crockett County, Texas. M. H. Chalumeau, 66 West 84th St., New York City.

WANTED. Partner that can finance 1000 ft. well at once. Had 22 years experience in all phases of producing oil. References exchanged. Chas. D. Robarts, 709 West 5th St., Cisco, Texas.

WANT producing lease for cash and oil payments. Send complete information and price. Box 2631, New Orleans, La.

NEW MEXICO—My weekly scout report furnishes complete and reliable information on New Mexico developments. Send for copy. W. S. Patterson, Santa Fe, N. Mex.

NEW MEXICO Oil and Gas Leases and royalties. Send 50 cents in stamps for new State Oil Map of New Mexico. Roy G. Barton, Clovis, New Mexico.

TREGO and Graham Co., Kansas, oil leases and Royalties, at very low prices. J. E. LEADER, Wakeeney, Kansas.

FOR SALE oil and gas leases and production in shallow territory. Will make price on leases, drilling and casing one or more wells. W. P. HARLEY, Bowling Green, Kentucky.

WANTED

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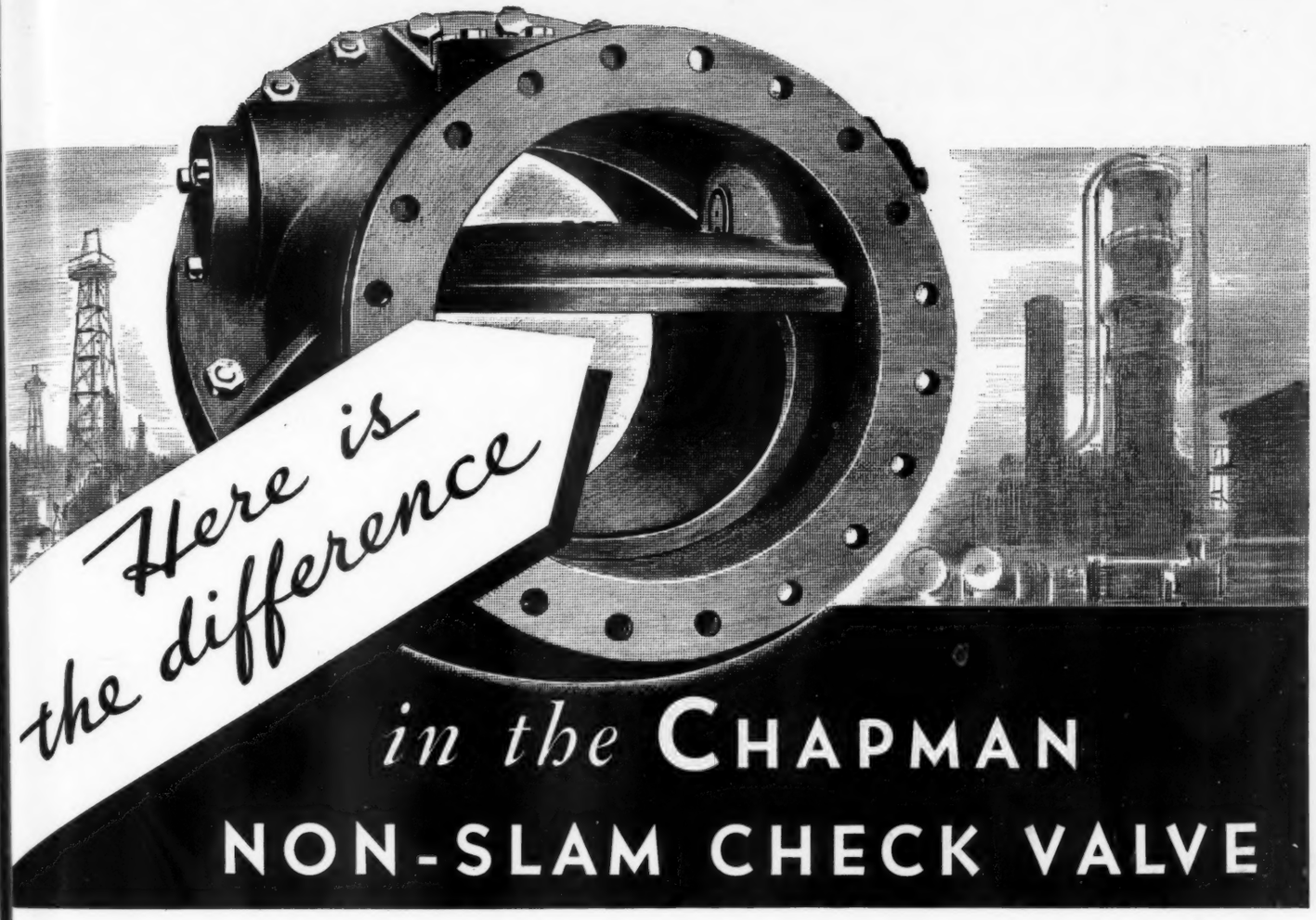

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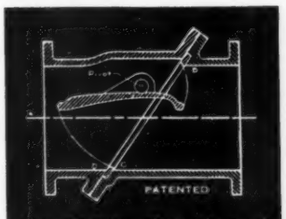

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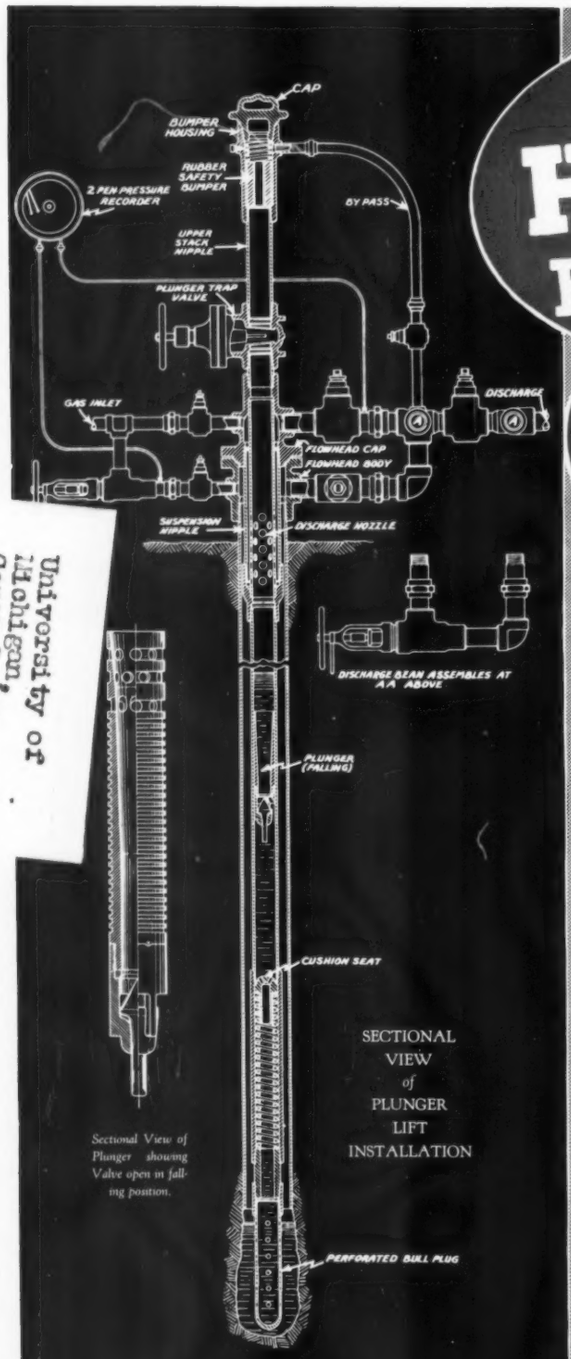

Sectional View of Plunger showing Valve open in falling position.

SECTIONAL VIEW of PLUNGER LIFT INSTALLATION

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The Hughes Plunger Lift is an apparatus adapted to produce oil from deep wells, using only the energy of the gas associated with the oil, or supplying additional gas where required.

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